Vol. 33 No 9

BULLETIN

OF THE

TORREY BOTANICAL CLUB

SEPTEMBER, 1906

Pteridophytes observed during three excursions into southern Florida*

ALVAH AUGUSTUS EATON

In November and December, 1903, I discovered in southern Florida several ferns new to the United States, of which a brief notice was published in the Fern Bulletin for April, 1904. As several species, at that time undetermined, were omitted from my account, and furthermore two subsequent trips have added other species new to the flora, it now seems best to bring all these little-known plants together, with somewhat careful descriptions which will make them the more readily distinguishable by fern students ; † and, moreover, to enumerate all the fernworts discovered in the course of my travels in Florida, with the hope that the notes so presented will add materially to knowledge of geographical distribution, as well as aid future botanical explorers. It is hoped, also, that the great ecological interest of the region will be so well suggested as to lead ecologists into southern Florida. Such lists as the present one, if carefully prepared, should be of much assistance when exact ecological surveys come to be made. Acknowledgments are due to Mr. B. D. Gilbert, Mr. William R. Maxon and Dr. L. M. Underwood for assistance in the determination of specimens.

ITINERARY

It becomes necessary to present a brief account of my itinerary. I arrived at Miami on November 6, 1903, where I met Dr. J. K. Small and Mr. J. J. Carter. Making Miami our base, we imme-

* Contributions from The Ames Botanical Laboratory, No. 4.

† The species added to the flora of the United States are indicated by an asterisk.

[The BULLETIN for August 1906 (33 : 403–454) was issued 30 Au 1906.]

diately began explorations of the surrounding territory, visiting the everglades and making excursions to localities southward; namely, Camp Longview (about 45 miles distant), the vicinity of Black Point (20 miles), and hammocks in the "Homestead" region (30 to 40 miles). We also explored most of the hammocks between Miami and Cutler, and made a trip up the canal from Miami to Fort Lauderdale and Boynton. On the 22d of November I left the other members of the party and went to Planter, on Key Largo, from there exploring the southern half of the key and the adjacent Plantation Key, and making a trip across Florida Bay to Madeira hammocks on the mainland. I returned to Miami December 3, and in company with Mr. John Soar and Prof. Chas. T. Simpson made a visit to Royal Palm, or Paradise Key, at the eastern end of Long Key, or Pine Island, lying in the everglade about 50 miles south of Miami. We explored some new hammocks in the Homestead region, to which I subsequently returned in company with Mr. Soar, when we revisited all the hammocks of the vicinity. On December 31 I was at Fort Lauderdale, and on January 1 at Jupiter, from thence going to Thomasville, Georgia, on the way home.

I returned to Miami, May 14, 1904. The copious rains prevented extensive exploration, but I revisited the hammocks about Miami and went to Black Point. On May 30 I left Miami for Oviedo, spending the thirty-first at that place. June 1 I was at Sanford and June 2 at Kissimmee. From thence I went to Tampa and took steamer for Braidentown, Manatee, and Oneco. Returning to Tampa I took passage by rail to Fort Myers, then by mail boat to Marco, and thence by skiff to Fahkahatchie Cypress and Everglade, whence I returned home.

In February, 1905, I revisited the hammocks about Miami. In March I went *via* Punta Gorda to Everglade. I made a trip to Deep Lake, about 15 miles through the cypress from Everglade. Then I engaged a gasoline launch with a man to run it and skirted along the whole coast to Flamingo, thus nearly completing a circuit of the peninsula. Returning in the launch I visited the headwaters of Whitewater Bay and touched at various places in the Ten Thousand Islands. I made another trip to the cypress, about 10 miles inland from Everglade. I stopped for a

day each at Fort Myers and Fort Ogden and then returned to North Easton.

PHYSICAL AND BOTANICAL FEATURES OF THE REGION

Miami is very near the northern limit of the coral formation which lies along the southeast coast of Florida from the vicinity of Miami about 50 miles southward. Northward from Fort Lauderdale the surface is overlaid by fine white silicious sand, with its characteristic vegetation. Between this place and Miami lies the borderland, where the southern calcareous rocks, of coraline origin, dip down gradually under the sand, and where, therefore, the latter lies here and there in patches and in pockets of the lime substratum.

Below Miami, we pass into a new world of plants. The limestone is usually bare of soil, save for a very small amount of humus lodged in the interstices, is irregularly eroded and leached away in the most fantastic shapes, and is for the most part exceedingly rough and full of hollows and sharp cutting points. This coastal lime formation is from 2 to 6 miles wide and is covered with a growth of *Pinus Elliottiana* to the practical exclusion of other trees. Ferns are very scarce on the higher elevations, but on the borders of the so-called "prairies"—incursions of the everglade—and hammocks, where there is more dampness, there is usually an abundance of *Ancimia adiantifolia* and *Pteris longifolia*. Along the sea front there is likely to be a mangrove swamp, inhabited by two species of *Acrostichum*. The Everglade proper is an open shallow lake in summer, the water receding and leaving large areas of damp marsh in winter. I found no fernwort in the open everglade.

All angiospermous woods are called hammocks by the Floridians; and hammocks may be classed as of two kinds, those of the everglades and river-borders and those of the pine woods. The first are simply low, occasionally inundated islands in the everglades or in the swamps bordering the rivers. The undergrowth is a tangle of small trees and shrubbery. I found no new epiphytic ferns here, but these hammocks are the home of several terrestrial species, some of them new. The pine-land hammocks are simply isolated pieces of angiospermous woods in the pine

forest. They are numerous and botanically are the most interesting regions. The largest, Breckell hammock, near Miami, is some three miles long and half a mile wide.

Often there is no apparent reason for the existence of these angiospermous areas in the midst of the pine forest; but in general the requisite condition is probably a porosity of the underlying rock, since the surface is usually more uneven as one approaches, and the hammocks are well supplied with sink-holes from 3 or 4 to 12 feet deep and of all diameters from a few inches up to many feet. The margins of these cavities are usually covered for some feet down with a fern flora characteristic of limestone regions and the trees and humus-covered rocks also bear a rich fern flora. A striking peculiarity of the region is that one hammock may bear an abundance of one species which may be absent from a neighboring hammock of apparently the same constitution. The surrounding pine-lands are almost free from sinks; but such sinks as do occur, and especially if holding water or if very damp, are often the site of *Odontosoria clavata*. Both the ferns and the other interesting herbaceous plants of the Homestead hammocks, as well as of those near Miami, will soon be only a memory, for the hammocks are already in process of destruction.

Of the hammocks mentioned in the list, Snapper is about 10 miles south of Miami. By far the most interesting are the hammocks in the Homestead region, near the new station of Gossman's on the extension of the Florida East Coast Railway; viz., Colwell's, Costello's, Ross's, Timb's and Bauer's, as they are called from the owners or nearest inhabitants. The southern portion of Key Largo is very low and much of it is subject to inundation by salt water. The rock is bare of humus and ferns are rare. The only species I saw at Planter and Newport were *Polypodium polypodioides* and *Campyloneurum Phyllitidis*. *Phymatodes exiguum* has also been found near the northern end of the island, but I did not visit that part. Conditions at Madeira are similar, but a marly sediment is substituted for coral. The region has been abandoned by all inhabitants because of frequent inundation by salt water. No new ferns were found there.

The conditions on the west coast of Florida are entirely different. The Ten Thousand Islands are mostly mangrove-covered

and tide-swept, most of the few habitations being on immense shell-heaps left by the aborigines. Even at Flamingo the shores are low, and impregnated with salt, and few ferns are found there. The same is true of Whitewater Bay. Back from the coast a few miles there stretches an immense belt of cypress forest, interspersed with open "prairie," all more or less covered with water during a part of the year. There is a coral outcrop about ten miles from Everglade on which a few pines are found, and a hammock similar to those on the east coast at Deep Lake, now mostly cleared and set with orange trees. The "cypress" proper bears few species of epiphytes and no terrestrials, but in the numerous "heads" (low places containing water all the year) there is a deciduous growth of pop-ash (*Fraxinus carolinianus*) and there are also hammock-like growths of oak and bay, on which some ferns thrive. Except for a small region in the Fahkahatchie cypress I saw no place which appeared especially congenial to ferns.

OPHIOGLOSSACEAE

OPHIOGLOSSUM PALMATUM L.

Very rare. Found only once on the east coast, in decaying leaf-bases and fern roots at the top of a cabbage palmetto at Snapper hammock, putting forth fruit in the middle of November. A few specimens were found at Deep Lake, 15 miles northeast of Everglade, and the species was found to be quite common on Alligator Bay, at head of Turner's river, about 20 miles south of Everglade. At the latter place the palmettos were in a narrow border of trees between the bay and the everglade, a strip too swampy to burn, to which fact — since the glade was yet smoking from a recent fire — I owed my specimens. The plants were growing in the interstices between the old leaf-bases at varying heights, but always in the loose fiber. This is very tinder-like and when ignited burns to the utter destruction of its epiphytic flora. The inhabitants set fire to whatever will burn, and the time seems not far distant when this *Ophioglossum* will be exterminated.

OPHIOGLOSSUM PUSILLUM Nutt.

A single very small plant of this species was found in a low sandy arm of the prairie in the pine woods at Little River.

Several patches were seen about the base of an Indian mound at Fort Lauderdale. The mound had been made on a level, damp, sandy place, a short distance from the river, and the plants were growing at the border of the saw palmetto growth. The roots are quite long and proliferous, sometimes with 2 or 3 young plants, and the colonies appear to have been formed by this method. One of my specimens shows the sterile leaf with three sori on each margin. This is the only instance of the kind I have observed in the genus, though partial reversion of the spike is not very rare.

HYMENOPHYLLACEAE

TRICHOMANES KRAUSII Hook. & Grev.*

Rootstocks matted, extensively creeping, slender, densely covered with short bristly root-hairs; stipes scattered, 3–10 mm. long, bristly radiculose below, often narrowly winged by the decurrent frond above; fronds broadly oblong to linear-oblong, 1.5–2 cm. long, 5–12 mm. wide, thinly membranaceous, pinnatifid nearly to the rachis, with a broad, usually angular, often closed sinus; pinnae linear and toothed to oblanceolate and pinnatisect, the segments rounded, each sinus bearing a single, black stellate-bristled tubercle; sori 3–13, partially immersed, the borders winged, the lobes rounded, free, spreading; column included or short-exserted; veins pinnate, one to each lobe, and occasionally a few short, spurious ones, especially as faint, broken, intramarginal nerves.

On roots, logs and bases of trees, often completely covering them, in humid hammocks. Border of the everglades at Camp Longview; Costello's hammock.

TRICHOMANES SPHENOIDES Kunze

Rootstocks matted, slender, bristly radiculose; stipes none to 2 cm. long, bristly radiculose below, often winged above; fronds 0.5–1.5 cm. long, 2–10 mm. broad, those of outlying new rootstocks cordate-orbicular and sessile, those of dense tufts passing through fan-shaped to oblanceolate, and linear-oblanceolate, irregularly lobed, incised, or parted, the margins with stellate reflexed hairs when young; indusia 1–11, included or mostly free, sometimes stipitate; veins dichotomous throughout or pinnate above.

In lime-sinks and rarely on tree-trunks in hammocks in pine woods, Costello's, Ross's, Colwell's and Bauer's; also in a hammock near the road, near Camp Longview.

Extremely variable as to shape and cutting of the fronds. Those on strong, new rootstocks are sessile, cordate, and nearly orbicular, always sterile, the edges brown with reflexed stellate bristles. Farther back from the end they become petioled, entire or more or less incised; in the dense tufts they are of various shapes, almost linear and entire when crowded and in deep shade, irregularly incised when well developed, so that no particular condition can be taken as typical. The receptacles are usually inserted at the base and winged somewhat at the sides, but they are sometimes almost completely included and at others are wholly exserted and on distinct pedicels. The round fronds are essentially those of *T. punctatum* of Hooker and Greville's Icones Filicum, *plate 236*; while many are exactly comparable with the illustration of *T. reptans* of the same work.

SCHIZAEACEAE

ANEIMIA ADIANTIFOLIA (L.) Sw.

Common in the limestone rubble of the pine woods, mostly a little back from the hammocks, where the surface is uneven, but occasionally in the shrubbery at the borders of the hammocks. In well-drained but not dry places, the stipes frequently reach a length of 4 dm. or more, the sterile segment a length of 2 dm. and an equal width, the total height of the frond 6.5 dm.

Rarely there are three spikes, one removed from the others and smaller, occupying the position of one of the basal pinnae: in other cases the apex of the sterile segment becomes elongated and fertile. Miami appears to be near the northern limit of this species, as the limestone extends only a short distance above, but it is abundant in suitable places throughout the pine belt to the southward. It is usually in company with *Pteris longifolia*.

SCHIZAEA GERMANI (Fée) Prantl

§ *Actinostachys*: Characterized by digitate pinnae and often four rows of capsules on a pinna.

Plants from bristly tubers sunk in rotten wood, sessile or elevated 1–3 cm; on a slender, smooth, castaneous rootstock; fronds 1–3 from a small castaneous-scaly, embedded bud; the stipe buried in humus and castaneous for the first 2–7 cm., then light-green,

triangular, and stiffly erect, 5–15 cm. tall, 1 mm. in diameter, surmounted by the capsular fructification; the latter composed of 2–4 pairs of erect, closely appressed linear pinnae; pinnae 8–15 mm. long, 1 mm. wide, green on the back, with two rows of capsules covering their inner faces, these interspersed with long, slender fibrils.

In decaying wood, sometimes in stumps 9–12 dm. from the ground, the bulbs buried sometimes to the depth of 10–12 cm. No sterile fronds were observed. The fruit looks very much like a very young ovary of *Pogonia ophioglossoides*, though smaller, and I did not guess the nature of the plant till I found an uncoiling frond. It was very scarce, found only in a small area in the tangled growth along Miami river across the Alapattah, on my second and third trips.

The genus *Actinostachys* is founded in part on the four rows of capsules on the pinnae, but as my specimens have only two the character would seem not to be common to all the digitate species. It would thus appear that this character is of little generic value, and in my opinion the digitate nature of the fronds alone is insufficient to erect a genus on, especially as they are not truly digitate, all of them having a short rachis, thus differing only in degree from *Euschizaea;* therefore I retain this species in *Schizaea.*

OSMUNDACEAE

OSMUNDA CINNAMOMEA L.

Apparently absent from the lower coast of the east side, though common about Fort Myers and found as far south as Harney's, or Shark river on the west coast, where I got fertile fronds a meter tall. Its common time of fruiting appears to be early November, as it was in full fruit in the middle of the state at that date, and bore no indication of fruit in March, save in the case of one plant.

OSMUNDA REGALIS L.

Quite common in the cypress swamps and damp hammocks bordering the everglades. The plants here form tussocks that may be 3 to 5 dm. high and sometimes only a decimeter through, covered with the densely brown-felted roots that are sent down from the growing crown and spread in all directions in the soft, black soil.

The southern plant shows a few fairly constant differences from the northern. The petioles of the pinnae are woolly with long, slender, tortuous and matted scales; the secondary rachises and mid-nerves of the pinnae are clothed with a similar though usually shorter tomentum; the pinnae are narrower, usually linear-lanceolate, 4 to 5 times as long as broad, the veins very prominent, and edges sharply serrate and indurated as though bounded by a marginal vein. It is also different in aspect, the fronds being more open and rather straggling. Specimens from Florida are very similar to those from the West Indies, Mexico and Brazil, and quite likely represent *O. palustris* Schrader.

POLYPODIACEAE

ACROSTICHUM AUREUM L.

On the east side this species was found only in the mangrove swamp bordering the bay at Larkins. A low narrow beach has been thrown up, so there is not a regular ebb and flow of the tide, but the salt water enters during storms and the soil must be quite salt. The plant grew in pools among the mangrove trees, mostly in little openings, where there was a strong diffused light; more rarely in the sun. The whole floor of the swamp was flooded and traversable only by stepping from root to root of the mangroves, mostly 3 or 4 feet from the ground. Although less common than *A. excelsum* and confined to brackish swamps, *A. aureum* has been supposed to be the only species of the genus in Florida. It is a smaller plant than the other species, being mostly less than 2 meters high; the stipes bear a few horny, black processes that might be considered rudimentary pinnae; the pinnae are farther apart, the fruiting ones being confined to the top, usually only a quarter or a third of each being fruited. The under surfaces of the sterile fronds are naked save for a few minute dark scales, mostly near the midrib; the basal areolations are elongated and parallel with the midrib, the others oblique to it. It is a less handsome plant than *A. excelsum*. The pinnae and rachis are very brittle, the former being thinner than in *A. excelsum*. It is the commoner species among the mangroves of the Ten Thousand Islands, always under the influence of salt water.

ACROSTICHUM EXCELSUM Maxon, Proc. Biol. Soc. Wash. **18**: 224. 1905

(*A. lomarioides* Jenman)

This is the largest fern growing in the United States. The species has been confused with *A. aureum*, from which it is most readily distinguished by its larger size, its close-set pinnae and the fact that all the pinnae of the fertile fronds bear sporangia. The stipes lack the spinous processes of *A. aureum*, and the under side of the sterile pinnae in all my specimens but one is covered with very short bristles. The basal areolations are not enlarged and are not parallel to the midrib; the primary veins spread at a greater angle, and are often parallel, and the connecting veinlets are often at right angles to them, the resulting areolations being more or less rectangular. The rootstocks are not infrequently 5–9 dm. long, 7–10 cm. in diameter, horizontal with an ascending tip, or assurgent, bearing numerous thick cord-like roots. The fronds may be 30–33 dm. long and 7.5 dm. broad, the stipes 2.5 cm. or more in diameter. Usually, especially in sunlight, the pinnae are abruptly ascending with the upper side facing the rachis. This habit is also seen in *A. aureum* and is not universal in either species. It is not confined to brackish shores, but grows well in the swamp hammocks bordering streams, less frequently in those of the everglades and the cypress. Although often growing where the water is fresh, it becomes scarce a short distance from the influence of salt water, and doubtless disappears entirely a few miles away from the sea. Not infrequently the pinnae bear one to several simple or forked lobes at the bases, on one or both sides, each lobe with a midrib that in the largest examples is branched from the main vein, but in the smaller ones melts away into the ordinary nerves before reaching it. Although several fronds of this structure may often be found on a single plant, the occurrence is simply accidental and the form may be known as *forma* **lobatum.**

STENOCHLAENA J. Smith

Fronds dimorphous, the fertile pinnae contracted, soriferous all over the back as in *Acrostichum*, the thin membranaceous margin often revolute.

STENOCHLAENA KUNZEANA (Presl) Underw. Bull. Torrey Club **33**: 196. 1906

This is a very pretty fern. The rootstocks are scandent, arising in and about the sink-holes and climbing neighboring trees. They are flattened dorsiventrally, rooting from the under surface, and at the growing end are rather sparingly clothed with thin ovate-lanceolate, acuminate, purplish scales. The stipes are arranged alternately along the sides of the rootstock and are from 5 cm. to 1.5 dm. in length. Their bases diverge at a very small angle and continue for some distance in the same plane, then curve backward till the frond stands nearly at right angles to this plane. They are flat and deeply grooved on the upper surface, while the edges bear a sharp ridge which becomes a narrow wing above. The fronds are from 1 to 4 dm. long and 3 to 9 cm. wide in Florida specimens, of a coriaceous texture and dark glossy green color, each pinna resembling a small holly leaf. They are more narrowly oblanceolate, abruptly contracted above and gradually so below. The rachis is grooved on the upper surface and broadly winged. The pinnae are articulated to the rachis, and are lanceolate from a cuneate base, the lowermost much reduced and roundish, the margins deeply serrate with divaricate teeth. The fertile pinnae are linear and densely fruited. I found this fern in four hammocks about Gossman's; *viz.*, Costello's, Ross's, Timb's and Bauer's. In all it was sterile save for one frond. It attained its best development in Ross's hammock, where rootstocks 12 dm. long were observed; but they are much longer in the tropics. It was found fruited in a hammock near Cocoanut Grove, in 1905, by O. Rodham.

POLYPODIUM PECTINATUM L.

First observed by Mr. Soar in Timb's hammock, Gossman's. It was growing on the ground, prostrate logs and bases of trees, and was quite scarce. Not observed elsewhere on the east coast. Found sparingly on magnolia trees at Oviedo, and abundantly over a small area in a hammock in Fahkahatchie cypress, on logs, stumps and cypress knees, but not found in two other trips to the cypress, nor at Whitewater Bay.

POLYPODIUM PLUMULA H. & B.

On magnolia trees with the last, at Oviedo; not observed elsewhere.

POLYPODIUM POLYPODIOIDES (L.) Hitch.

Principally on hardwood trees; very common throughout my itinerary except on the keys, where but few plants were observed.

PHYMATODES EXIGUUM (Hew.) Underw. Torreya **3**: 18. 1903

On my second trip to Bauer's hammock, Mr. Soar called my attention to a small fern with sterile, obliquely ovate to lanceolate, obtuse or rounded fronds, 1–2 cm. long, growing over the limestone and on roots and twigs. I immediately concluded it was *Phymatodes exiguum* and began a search of the surrounding trees for it. It proved to be abundant in a spot perhaps 40 meters across, mostly on small trees. The rootstocks were found to have their origin in the sterile phase on the ground, to grow up the trunks of the trees and shrubs to a height of twenty feet or more and spread out on the branches of the shorter ones. They are mostly simple, are clothed with dark-brown scales, and are closely appressed to the tree, holding on by the numerous, short, alternate roots. The fronds are alternate and confined to 3–4 dm. of the upper portion; are approximate and comparatively short and broad, mostly rounded, when sterile; and narrowly lanceolate, 6–15 cm. long (including stipe) and 5–12 mm. wide, when fertile, acute or acuminate at tip, obliquely acuminate at base. As most of the fronds are several feet up the small trees, often on branches where they appear like the proper leaves of its support, this fern is easily overlooked and may be expected in abundance as soon as collectors become familiar with it. The first locality on the mainland. Found by Curtiss on the north end of Key Largo, where it has since been collected several times.

VITTARIA LINEATA Sw.

Very common on palmettos throughout; sometimes on other trees. In favorable localities in shaded hammocks, the grass-like fronds are sometimes in large clusters that must contain thousands, and are up to 10 or 11 dm. in length.

PHLEBODIUM AUREUM (L.) J. Smith

Very common on palmettos, mostly in the decaying leaf-bases near the crown, occasionally found on logs or other trees than the palmetto, rarely on the ground. Apparently rare on the keys. At Madeira hammock there is a glaucous form.

CAMPYLONEURUM ANGUSTIFOLIUM (Sw.) Fée*

Plants epiphytic; rootstocks 1–3 cm. long, 0.5 cm. wide, marked at the naked proximal end by close-set, cup-shaped leaf-traces crossing diagonally in 3's, clothed at the living end with narrowly lanceolate-acuminate, seal-brown scales; fronds 6–12, about half being of the current year's growth, the rest of the preceding year's, the two cycles usually separated 0.5–1 cm.; stipes clustered, short, 3–5 cm. long, slightly grooved above, winged laterally, passing gradually into the fronds; fronds narrowly linear-lanceolate, usually somewhat falcate, long-acuminate, 2–4.5 dm. long, 0.5–1 cm. wide, leathery, the veining obscure; primary veins often zig-zag, the first branch arising from near the base on the upper side, soriferous just below the apex. The vein that encloses the upper edge of the basal areole often bears a branch above the middle, this occasionally soriferous, the sori thus being in a regular or somewhat broken line on each side of the midrib, about half-way to the margin.

On trees, mostly live-oaks that bend considerably from the perpendicular, growing on the upper side; also on branches among tillandsias; the fronds at first at right angles to the rootstock, then recurving toward the base of the tree. Considerable numbers seen in Timb's hammock; not observed elsewhere in South Florida. First discovered by Mr. Soar. Also seen on magnolias at Oviedo with *Polypodium Plumula* and *P. pectinatum*; first discovered by Mr. T. L. Mead (not J. E. Layne, as reported in Fern Bull. for April, 1904). Not seen by me on the west coast, but reported by Mr. Oakes Ames to be common in the "bay heads" near Naples.

CAMPYLONEURUM COSTATUM (Kunze) Presl*

Rootstocks much as in *C. Phyllitidis*, clothed at growing end with narrow, flexuous, triangular-acuminate dark-brown scales; stipes in two rows, 4–14 cm. long, smooth, green or castaneous beneath, rounded on the back, green and flat above, with a narrow sharp groove in the center, the edges bordered by a narrow, in-

durated, decurrent wing, not visible above, but set off from main stipe below by a narrow groove; rachis narrow and costate below, broad and flat above; fronds smooth, coriaceous, shining, linear-oblong to oblong-oblanceolate, 2–3 dm. long, 3.5–5.5 cm. wide, often widest near the apex, then abruptly contracted into an acuminate point 2 cm. long, gradually attenuate at base, the margins entire or nearly so, with very narrow hyaline border; veins obscure, the free veinlets which arise from the united apices of the cross-veins often continuous as a sub-nerve, dividing the space between the main nerves into two quadrate areoles, each of which bears one, sometimes two sori on the enclosed free veins.

Differs from *C. Phyllitidis* in its petioled fronds, and from *C. latum* principally by the scales of the rootstock, the flat stipes, the outline and coriaceous texture of the fronds. Abundant on trees, logs and cypress knees in a hardwood hammock in Fahkahatchie cypress, June 11, 1904 (*no. 1135*). Apparently local, as it was not seen in two trips of several days each into the cypress in March, 1905.

CAMPYLONEURUM LATUM Moore *

Rootstocks 2–7 cm. long, 5–7 mm. thick, green at the growing end, clothed with asymmetrically peltate, imbricated, irregularly lobed, light seal-brown scales; stipes 4–6, clustered, flat on back, deeply centrally grooved above, slightly laterally grooved when dry, the sides folding in in drying and covering the upper surface, giving a triangular section; leaf-scars 5 mm. long, in a single row; fronds oblong-lanceolate, broadest in the middle, with sinuate, undulate or entire edges, 2–6 dm. long, 4–9 cm. broad, obtuse or acuminate at apex, gradually or rather abruptly contracted at base, smooth, dark-green above, lighter below, usually with a small scar or gland on the upper side of the main nerves near the base, the epidermis silvery-punctate about the stomata; midrib flat above, the back flattened below, the sides strongly concave, the edges sharp, bearing a few orbicular to oblong, basally peltate or deeply cordate scales along the sides; primary veins 5–7 mm. apart, the secondary irregularly anastomosing into 2–3 areoles, each of which may bear 1–3 free veinlets, or the central none; sori mostly in two rows between the main nerves.

Differs from *C. Phyllitidis* in the shape of the scales, the long stipes and the shape and color of the fronds. Found about the sides of a large lime-sink and on the bases of trees overhanging

it in Bauer's hammock, Gossman's. First observed by Mr. Soar. Very scarce.

CAMPYLONEURUM PHYLLITIDIS (L.) Presl

Abundant in nearly all hammocks visited, and various in position, oftenest on decaying vegetable matter on the ground, or on prostrate logs. In particularly favorable places plants grow to a large size and are often on trees, sometimes at a height of ten meters or more. Rare on the Keys, only one or two seen on Key Largo, none on Long Island (Plantation Key); and but few at Madeira hammock, Flamingo, and Whitewater Bay. The largest frond collected is rather more than a meter long and 7 cm. wide.

MENISCIUM Schreb.

Simple or pinnate ferns with naked sori borne on the arched cross-veins which form regular areoles between the parallel primary veins. Differs from the subgenus *Goniopteris* of *Dryopteris* principally in its elongate sori.

MENISCIUM RETICULATUM (L.) Sw.*

Rootstocks short, stout, ascending; stipes stout, 2–15 dm. long, 4-ridged above, sparingly clothed at first with small, thin, irregular brown scales, soon naked; fronds 2–14 dm. long, 1.5–9 dm. broad, oblong-lanceolate, as broad at base as at middle; rachis 4-ridged and hairy above, smooth beneath; pinnæ 1–4.5 dm. long, 2–7.5 cm. broad, shortly petiolate or sessile, oblong to lanceolate, the sterile broadest at middle, the fertile with sides parallel to middle, thence narrowed to the long-acuminate point, the edges irregularly repand-toothed or subentire, rounded or mostly asymmetrically cuneate at base, the lower side somewhat rounded, or in upper pinnae decurrent on rachis, the upper edge straight; rachises of pinnae smooth below, hairy and centrally grooved above; primary veins parallel, secondary forming regular arched areoles, the top of the arch bearing a short incrassated veinlet that reaches to the middle of the superior areole; areoles 8–20 between midrib and margin; petioles of lower pinnae usually, and of others quite often, giving rise to bulbils which develop into plants, the buds and stipes covered with brown scales.

On cypress knees, border of the everglade at pumping station at Alapattah. This was first found in Florida by the late J. E. Layne in the spring of 1903, who likewise found it in a cypress

swamp and sent a few pinnae only to Mr. J. H. Ferriss. Mr. Layne's plants came from Fahkahatchie near Everglade, Lee County, and his guide informed me that it grew on cypress knees.

This magnificent fern is a close competitor of *Acrostichum excelsum* in size. There are perhaps 40 large plants and many seedlings of it growing on cypress knees in the tangled hammock north of the old Miami pumping station. My first plants were only 1.5–2 dm. high, but were sufficient to convince me that here was an unreported fern and to spur me to an extended search, which was rewarded by plants with fronds 28.5 dm. long by 9 dm. broad.

The rootstocks are thick, covered with bases of old fronds, several inches long, clinging to the older, often decaying and humus-filled, cypress knees by numerous roots. They were usually above the flood line, and wound over the small knees, about a foot from the forest floor. In no instance did I see one rooted in soil.

The fronds are rather firm, but not coriaceous. The bulbils are formed at the apex of an appressed basal nerve, on either or both sides of the petiolule of a pinna. As the nerve thickens to correspond with the size of the plantlet the latter can not become detached and can only take root by the bending of the parent frond toward the earth. The plantlets thus grow in situ, sending out roots and fronds, the latter sometimes a foot long, well developed and fructiferous. The stipes and veins are smooth and stramineous save for a narrow chestnut axillary band at base of each pinna.

The sterile pinnae are somewhat narrowed at base and broadly and obliquely cuneate, or more rarely narrowed and somewhat rounded to the short petiole. The fertile are usually more sharply cuneate, the lower margin starting at the point of insertion and somewhat rounded to the angle, the upper margin starting 2–4 mm. from the axil and running straight or somewhat incurving to the angle, making the base oblique. The pinnae of the sterile fronds are often broadest near the middle, but the fertile usually attain their greatest width 12–16 mm. from the base and hold it to or beyond the middle, whence they are very gradually long-attenuate.

The primary veinlets spread nearly horizontally at first,

gradually sweeping upward to the margin. They are very regularly placed and parallel, and very distinct on both surfaces because of their stramineous color. They are flat on the upper and somewhat prominent on the lower surface. The cross-veinlets are also regularly placed and parallel. The lowermost starts at or near the axil of the vein, runs obliquely upward to a little above the middle of the space, then turns abruptly down to the base of the vein above, describing a broad inverted V. Other veinlets follow in regular succession at a distance of about a millimeter. At the outer angle of the V there is a free clavate vein reaching nearly to the inner angle of the next above. The sori are naked, and are formed along both sides of the V-shaped veins, beginning at the angle in less fruited specimens. Usually the sori are confluent in the later stages, covering the whole back of the pinna, even to the apex, with cinnamon-brown spore-cases, divided into parallel bands by the stramineous veins.

The species appears to be quite variable, and is found throughout the West Indies and Mexico to Brazil, and finds a counterpart in *M. cuspidatum* Bl., of the Sunda islands.

ADIANTUM TENERUM Sw.

This beautiful fern was abundant in the hammocks of the pine woods, growing mostly in and around lime-sinks, in rich leaf-mould. Most of the plants were in full vigor, although a few had lost their pinnae. In Timb's hammock a clearing had been made, the trees being simply felled and allowed to decay. Here the ground was completely covered in places with tangles of this fern, the sinks being lined with the young plants. At this place I found a clump of plants, all sterile, that strongly resembled *A. Farleyense*, the pinnae being large, sometimes 3 cm. long and broad, cuneate at the base, very deeply cleft, the lobes mostly rounded. The species was found only in limestone hammocks and is apparently absent from the lower counties of the west coast.

PTERIS AQUILINA PSEUDOCAUDATA Clute

Apparently absent from the rocky woods of South Florida, but abundant about Oviedo and Sanford in central Florida and about Fort Myers on the west coast. Confined to dry sandy regions, so far as observed.

PTERIS CAUDATA L.

Quite common in the pine woods and on borders of hammocks, small when in dry situations but attaining a great size when in fairly moist humus. At Orange Glade there was an abandoned Indian camp that was a complete tangle of this fern, some specimens being 36 dm. high, with a spread of 18 dm.

PTERIS LONGIFOLIA L.

Common in the rough limestone a little back from hammocks and in small lime-sinks and pot-holes in pine woods, usually in company with *Aneimia adiantifolia*. Sometimes 11.5 dm. high and 12 cm. wide when growing in deep shaded cavities. Not observed save in the limestone region.

BLECHNUM SERRULATUM Rich.

Abundant throughout, in fresh-water swamps, in the rich mucky hammocks bordering the streams and everglades, and in the cypress of the west coast. In sunlight the fronds are erect, the pinnae ascending or erect, and the plants are rather small, being only 4–6 dm. tall; but in rich moist hammocks they often exceed 18 dm. in height and 3 dm. in width, clambering among the shrubbery. At a little distance the species has the appearance of a large *Polystichum acrostichoides*. In sandy swamps the rootstocks creep just beneath the surface and are about 5 mm. in diameter, covered with narrowly lanceolate, almost bristly, scales. In the heavy cypress of the west coast, where subject to inundation for much of the year, the rootstocks become erect, sometimes 5 dm. long, 1–1.5 cm. in diameter, irregular, finely rugose-roughened, and bear a crown of fronds, often a few roots also, at the top. At Flamingo the soil is too salty for it, but I found one plant, with the rootstocks several feet long, winding about in the decayed leaf-bases of a cabbage palmetto at the height of ten feet from the ground. The rootstocks were about as thick as in the normal form and similarly clothed, but the fronds were much thinner and doubly serrate.

WOODWARDIA AREOLATA (L.) Moore

Not found in the lower counties of the east coast. It grew in the ditches and thickets on the border of the Caloosahatchee

at Fort Myers, the southernmost point at which it was seen. There was no evidence of fruit in either March or June.

WOODWARDIA VIRGINICA (L.) J. E. Smith

Sandy cypress-swamps at Fort Lauderdale and in the thickets near the river at Fort Myers. The southernmost points at which it was observed. Sparingly fruited in December and March.

Asplenium biscaynianum (D. C. Eaton) A. A. Eaton

Asplenium rhizophyllum var. *biscaynianum* D. C. Eaton, Bull. Torrey Club **14**: 97. 1885.

Rootstocks short, erect, clothed at tip with linear-lanceolate, brown, white-fenestrate scales; fronds 10–50, erect; stipes 4–15 cm. long, 1/4–2/5 the entire length, dull-castaneous with a few fenestrate and many scattered small membranous scales when young, smooth when old, angled on front at base, the angles becoming green wings above; rachis castaneous beneath, green above, winged; lamina 1–2.5 dm. long, 1.5–3 cm. wide, linear-oblanceolate, broadest above the middle, bipinnate; pinnae 12–20 pairs, obliquely ascending, 1–2 cm. long, 0.5–1 cm. wide, the lower remote, the upper approximate, dark-green, rather firmly herbaceous, with 5–7 pinnules; the lowest superior pinnule is cuneate-obovate, with a midnerve that gives off 2–6 branches, each of which ends in a short, obtuse or acute lobe; the second and third and often the fourth and fifth pinnules are 2–4-nerved with as many lobes, the next one or two linear-falcate, the terminal one similar to the basal but more deeply lobed; sori large, often exceeding half the length of the pinnule, 2–4 to each of the larger, one to each segment of the terminal and one to each of the narrow intermediate ones; on the latter they are submarginal, facing the midrib, and are often incurved, giving the pinnule a falcate appearance; indusia firm.

This fern was found abundantly at the bluffs near the Punchbowl in Breckell hammock, in company with *A. dentatum* and *A. verecundum*, between which it appears to be an almost exact intermediate in cutting, having the erect caudices, long stipes, firmer texture and large sori of the former and the larger size and brown stipes of the latter. At the time of collecting I was struck with the aspect and habit of this plant, and wondered if it could be a hybrid. I was somewhat surprised on referring to Holden's note in the Bulletin of the Torrey Club (*l. c.* 97) to find that I had

happened on the type station of the fern, and that he had also surmised that it might be of hybrid origin, a view in which D. C. Eaton appears to coincide. The cocoanut tree he mentions is now quite large and often resorted to for fruit. Evidently Mr. Holden did not explore the bluffs far enough to get the best specimens, as he mentions but one recess where they grew. The bluff faces the east but is protected from the sun by a fine growth of mangroves, the moisture of the soggy earth beneath them keeping up a considerable humidity. The bluff arises to a height of 6–10 feet and its shelving walls and recesses, as well as detached boulders at the base and the rocks of the neighboring woods above are carpeted with *A. dentatum*, *A. verecundum* and this species, which though common is the least so of the three. An extended search for half a mile along the bluff failed to show any individuals of *A. biscaynianum* removed from the other species.

Though having most of its characters in common with one or both of its associates, the aspect of *A. biscaynianum* was peculiar to itself, the fronds being erect, the stipes long, pinnae remote and ascending, bipinnate, the pinnules often with 2–5 sori, while in *A. verecundum* the stipes are short (1/5 or less of the total length of fronds), the fronds spreading, tripinnate, the pinnae longer, spreading nearly or quite at right angles, the segments rounded on the inner face, the sori small, one to each segment, remote from the margin. From *A. dentatum* it is most readily distinguished by the large size and the cutting. The uppermost pinnae of the frond are often very similar to those of *A. dentatum*, but are not oblique nor auricled, and the main nerve is in the middle.

ASPLENIUM DENTATUM L.

This species does not appear to thrive so well in the small lime-sinks as does *A. verecundum*, very few plants, and these not thrifty, being found in them. It is at its best on nearly perpendicular walls of limestone, where sufficiently shaded. It is usually abundant where found at all. Breckell hammock, bluffs north of the Punch-bowl and on rough coral-rock in the woods; roadside, hammock near Cutler, on sides of large sinks and on boulders; Costello's hammock, in small sinks.

ASPLENIUM SERRATUM L.

This fine fern was first shown to me by Dr. Small in Snapper hammock, about ten miles below Miami. Subsequently I found it at Costello's and Ross's hammocks in the Homestead region, and at Breckell hammock near Miami. At Costello's there were but few plants, but at the other places they were abundant, growing on the ground, prostrate logs, and even on the bases of the trees. The caudices are short, erect, felted by the many roots, the fronds ascending or somewhat drooping at the tips. Their color is dark, glossy green. It grows in rather low places in the hammock, but not where swampy, and is subject to thorough drying out in the winter. It was abundant in Fahkahatchie cypress, Lee County, in a hammock of live-oak, growing on tree trunks, decaying logs and cypress knees down to the high-water mark. At the last locality there were a few plants with the margin of the frond above the middle irregularly incised, sometimes half way to the midrib. This may be characterized as *forma* **incisum.**

ASPLENIUM VERECUNDUM Chapm.

This was the most delicately beautiful of all the ferns found on the trip. It was first seen at Costello's hammock, but was subsequently found in several other hammocks in the vicinity, and on the face of the bluff and in adjoining woods near the Punch-bowl in Breckell hammock. It usually grows on the sides of the lime-sinks, but often in irregularities of the rock, in the more humid places, as for instance near the large sinks. Near the sea at the Punch-bowl it grew on detached boulders or the bare rock.

The well-like sinks, often six to ten feet deep, round as if shaped by man, form a peculiarly fitting home for this fern, and often the sides are lined with it to a depth of several feet. The large, older fronds appear to be dark-green, while the young ones, being thin and delicate, catch and reflect the light as do some cave mosses, appearing as a delicate silvery mesh over the dark background. In texture and cutting they are strikingly like some filmy ferns. The water at the bottom of the well keeps the air humid, a condition apparently necessary for the fern. The stipes are very short, mostly less than 6 cm. even on the largest plants, and the fronds

grow in such a way as to conceal them, then spread radially. My largest fronds are 3.5 cm. wide and 27 cm. long, exclusive of the stipe. There are sometimes 70 in a cluster. This is the species that heretofore has been known as *A. myriophyllum*, which appears to be distinct. I have not been able, however, to distinguish it from *A. monteverdense* Hook. of Cuba.

DRYOPTERIS AMPLA (H. & B.) O. Kuntze *

Rootstocks erect, often 4–5 dm. high and 5–7 cm. thick, covered with fine, loose, ferruginous, woolly scales; stripes in a crown at the end of the rootstock, erect, 4–8 dm. long, densely clothed below with woolly, ferruginous scales 3–4 cm. long and more sparin, ly above with short hairy scales; fronds triangular, 3–7 dm. long, by nearly as broad at base, quadripinnatifid at the base, tripinnatifid above; rachises and principal veins clothed with light-brown hairy scales, and a shorter, fine puberulence; texture thin and herbaceous; lower pair of pinnae much the largest, petioled, anadromous with one to three, but usually two, secondary pinnae on the upper side before there are any on the lower; the first lower secondary pinnae much the largest, but the others of the lower side gradually reduced till they equal the upper ones near the tip of the pinnae; upper pinnae catadromous; secondary pinnae lance-triangular to linear-lanceolate, acute; segments linear-oblong, rounded, entire or crenate, the lower ones incised; sori small with fugacious indusia, in a single row on each side of the nerves of the ultimate segments.

In Costello's and Ross's hammocks, and another small hammock in pine woods a mile northeast of Colwell's. A very striking large fern with a texture much like *D. noveboracense*, quite easily taken for a *Phegopteris* because of the very fugacious indusium. It is found throughout the West Indies and southward to Ecuador.

DRYOPTERIS FLORIDANA (Hook.) O. Kuntze

Apparently absent or rare in the southern counties of the state. I saw it in Florida only in the rich hammock at Oviedo, where I made a stop of one day. In company with Mrs. A. P. Taylor, I had previously found it at Thomasville, Georgia, which proves to be its most northerly extension. It is a noble and beautiful fern, recalling *D. cristata Clintoniana* in aspect.

DRYOPTERIS PATENS (Sw.) O. Kuntze

Very common throughout on the east coast, less so on the west coast. Apparently prefers limestone in damp situations. When growing in exposed places the pinnae often contract, at first vertically, then spread and describe a half-circle at the tip, being of precisely the appearance of *D. simulata* under similar circumstances. At Colwell's hammock I got a specimen with the rachis, pinnae and indusia covered with glandular capitate hairs instead of the usual long white pubescence. This may be known as variety **glandulosa.**

DRYOPTERIS REPTANS (Gmel.) C. Chr.

(*Phegopteris reptans* D. C. Eaton)

This interesting plant was abundant about the lime-sinks in the hammocks of the Homestead region, and was extremely variable. The normally fruiting plants resemble undersized *D. parasitica* (*Nephrodium molle*), the aspect being similar and the venation identical. Other plants have few or no fruiting fronds, the sterile ones filiform, pendent, 3–6 dm. long, frequently rooting and giving rise to new plants. The sporangia are deciduous from the persistent pedicels. The sori of my specimens possess small indusia which are bristly-fringed on the edges. As the species is closely related to *D. parasitica*, being put in a separate genus solely on account of the absence of indusium, it seems best to treat it as a *Dryopteris*.

DRYOPTERIS SETIGERA (Bl.) O. Kuntze *

Rootstock stout, creeping or assurgent, clothed with copious long-subulate, ciliate, dark-brown scales; fronds 8–10, the stipes when fully developed 1–1.5 cm. in diameter and 6 dm. long, light-green with whitish cast as if pruinose, densely clothed at base with scales like those of the rootstock, with an under tomentum of short, white, bristly hairs, these sometimes on the scales also, naked above; laminae 7–9 dm. long, membranaceous, triangular-ovate, acuminate, quadripinnatifid, the second pair of pinnae longest; primary and scondary rachises smooth below, grooved in each side above, the portion between the grooves, as well as the costae of the ultimate pinnae, more or less densely clothed with fine white bristle-like hairs; primary pinnae oblong-lanceolate, the largest 3–4 dm. long, 1–1.5 dm. wide, more or

less winged beyond the middle by the decurrent bases of the secondary pinnae; sccondary pinnae triangular-lanceolate, acuminate, contiguous, the rachises narrowly winged; ultimate pinnae linear-oblong, obtuse or rounded at apex, nearly smooth above, more or less setigerous beneath, cut half-way to the costa by about seven pairs of rounded, toothed segments; veins of lower segments forking once or twice, those of the upper ones simple, thickened and prominent on the upper surface at the apex; sori 1–3 on the lowermost segments, one on the upper, approximate near the main rachis of the pinna; indusia fugacious.

A very fine large species, widely distributed in India and Malaysia, now apparently well established in a piece of swampy woods at Oviedo, having escaped from the greenhouse of Mr. T. L. Mead. The fronds are often more than 15 dm. in height, the stipes succulent and whitish as if covered with a bloom. The basal scales are sometimes 1 cm. long by about 1 mm. wide, bristly-ciliate on the margins and not infrequently setigerous on the surfaces. In falling they leave brown, inverted V-shaped scars. Mr. Mead procured the original plants from Reasoner Bros. of Oneco, as *Cibotium Baromctz*. It is a very prolific species, and spores of some plants I procured from the same source germinated freely in other flower-pots in a living-room, and came to maturity. It would thus appear amply able to take care of itself in the rich swamps of middle Florida.

DRYOPTERIS STIPULARIS (Willd.) Maxon *

Rootstock erect, 7.5 cm. high, about 3 cm. thick; stipes 3–5.5 dm. long, 3–4 mm. thick, terete, light-green, scaly and finely pulverulent at base, smooth above; scales very dense at base, the lower 1 cm. long, 5 mm. wide, the upper smaller, falcate, acuminate, very thin and hyaline, soon withering and deciduous; rachis, nerves and indusia more or less strigose-pubescent; fronds 4–6.5 dm. long, 2–3.5 dm. wide, gracefully arched, broadly lanceolate, pinnate; pinnae approximate, opposite or nearly so, linear-acuminate, the lower pair approaching and deflexed; the upper basal segments of the lower 3–4 pairs enlarged, 1–2.5 cm. long, 0.5–1 cm. broad, with 5–10 pairs of segments, often fruited, having the aspect of miniature pinnae, deflexed under the frond at right angles to point of insertion. Aspect very similar to that of some forms of *D. patens* but readily distinguishable through the stout erect rootstock, the large chaffy scales and stipular appendages of the lower pinnae.

One plant only, collected February 1905, in a hole in the limestone six inches across and about 2 ft. deep, in a clearing in Ross's hammock. It is now thriving in a greenhouse at North Easton. It had but 4 fronds when found. It was in a tangle of *D. patens*, and was noticed because of its brighter green color and more graceful carriage.

DRYOPTERIS THELYPTERIS (L.) Gray

Common in low mucky swamps where the water is fresh, on both coasts. On the side of the prairie between the pine woods and mangroves at Black Point I collected plants 11.5 dm. long. Florida specimens have a slightly different aspect from those of the north, the pinnae being proportionately shorter and the basal pair of pinnules 1/3 longer than the next pair, and serrate or undulate.

DRYOPTERIS UNITA GLABRA (Mett.) Underw.

In the low hammocks of the everglades where inundated most of the year; also in the tangled shrubbery along the Miami. My largest frond is over 21 dm. long and 4.5 dm. wide. It has the appearance of a large, glossy *D. Thelypteris*. The rootstocks sometimes grow out over the surface of the ground for a distance of a meter or more. They are slightly scaly, dichotomously forking, slightly flattened dorsi-ventrally, green at tip but soon glossy black. I did not observe this species on the west coast.

Tectaria Amesiana sp. nov.

Rootstocks short, creeping, the dead portion covered with terete stipe-bases, otherwise naked, the living portion clothed with lance-acuminate, brown scales; stipes 5–10, clustered, 1–3 dm. long, slender, flat above, slightly rounded below, light-castaneous, sparsely beset with deciduous lance-acuminate, brown scales, very finely puberulent-scaly at base and on upper surface; fronds 10–16 cm. long, 3–6 cm. wide, with 1 or 2 pairs of pinnae and a large terminal one; rachis and principal veins puberulent, especially above; lower pinnae distant, petioled, more or less cordate, obliquely triangular-ovate, with about three coarse rounded lobes on each side, those of lower side largest, the segments and terminal portion sinuate or undulate; second pair of pinnae (when present) oblong-lanceolate, obtuse, adnate to rachis, coarsely

round-lobed or sinuate-undulate, most deeply on lower edges; terminal portion equaling one half the frond or more, lanceolate, acuminate, with 3–4 blunt sinuate lobes on each side, passing to mere undulations near tip; veins forming regular large paracostal areoles and 2 or 3 large meshes beyond, mostly united at the edge of the frond, often, especially in sterile fronds, with included, simple or forked free veins; sori mostly at a fork on the middle of the paracostal nerve; indusia firm, ample, nephroid, usually firmly pressed over the sorus and with a free edge beyond.

In three lime-sinks in Bauer's hammock, difficult of access as it grew on the perpendicular walls out of reach. This fern was first collected as an extreme form of *T. minima*, which in carriage, general cutting and vestiture it resembles. A careful comparison, however, shows it to be intermediate between that and *T. coriandrifolia*, with which it was associated in two places, and it may possibly be a hybrid between those species. The rootstocks of the three are almost identical. The aspect is nearer that of *T. minima*, which it also resembles in the flattened stipe, the fine puberulent scales of the stipe and veins, in the texture, the cordate basal pinnae, the lower side of which is somewhat auriculate, and in the more or less irregularly placed sori. It also lacks the proliferous bulbils of *T. coriandrifolia*. The areolation is more like that of the latter species, though free veinlets are not rare, especially in sterile fronds. The sori are also nephroid, a condition which is also found occasionally in *T. minima*. Dedicated to Mrs. Oakes Ames.

TECTARIA CORIANDRIFOLIA (Sw.) Underw.*

Rootstocks short, creeping, covered at the growing end with lanceolate, filiform-acuminate, brown scales; stipes 6–15, clustered, nearly terete, spreading, 2–6 cm. long, with a few brown scales at base, clothed, as well as the rachis, with hair-like, contorted, gray or brown scales; lamina pubescent, especially on the nerves, oblong-lanceolate, slightly narrowed below, 6–10 cm. long, 2.5–3 cm. broad, proliferous at the axils, thin, darkening in drying, with 1–3 pairs of remote pinnae and a terminal lanceolate pinnatilobed one; lower pinnae shortly petioled, obliquely ovate with 2–4 rounded lobes, the lower basal ones much the largest; second pair of pinnae blunt-lobed below, sinuate or entire above; terminal pinna 8–10 lobed, the segments rounded, entire or more or less toothed; veins forming large paracostal areoles along the

rachis and midnerves and one or two between them and the margin, the ends mostly free; sori few, in a row on each side of the midnerve, borne in a fork of a paracostal nerve at about the middle; indusium reniform, withering-persistent.

In lime-sinks, Bauer's hammock, Gossman's. This hammock is nearly half a mile long and one quarter mile wide, in some places with abundant sinks. This fern was found in but three of these, rooting in the rough rocks of the sides from two to six feet down, spreading extensively by the proliferations of the fronds.

TECTARIA HERACLEIFOLIA (Willd.) Underw.

Rootstocks stout, erect, 1–3 dm. tall and 3 cm. in diameter, sometimes aggregated into erect clumps 5 dm. tall and 1 dm. in diameter, overlaid with wiry roots, clothed with long lanceolate-acuminate dark-brown scales, the bases of which persist; stipes 2–6 dm. long, stout, castaneous, shining, nearly flat above, grooved on sides, with a few lanceolate-acuminate deciduous scales at base, and more or less puberulent with very fine scattered or matted scales; fronds ternate, ample, 1.5–5 dm. long, 1–4 dm. wide, chartaceous, glossy above, dull beneath, surface smooth, all the principal veins finely puberulent, especially above; lower pair of pinnae mostly distinct, often petioled, mostly auricled at base, upwardly falcate, acuminate, with a large upwardly falcate, acuminate, coarsely crenate or lobed basal pinnule and several other blunt, shallow lobes passing to undulations above, or in larger specimens often more cut; second pair of lobes often distinct, upwardly falcate, more or less lobed or incised; terminal portion triangular-ovate, more or less incised or coarsely lobed below, entire or undulate above, acuminate; young fronds ovate-lanceolate, acuminate, cordate, the sinus closed, with one or two rounded shallow lobes at base; paracostal areoles with free veins or often small areoles, the rest of areoles irregular, mostly with free, simple or irregularly branched included veinlets; sori large, round, irregularly placed but mostly in two rows between the veins, on an angle or fork of the first branch of the veins that form the paracostal areoles.

Growing in small lime-sinks in hammocks of the Homestead region. A large glossy beautiful fern, very different in aspect from the next. Apparently absent in some hammocks where that is abundant. This fern has been known as *Aspidium trifoliatum*, from which it is distinct.

TECTARIA MINIMA Underw. Bull. Torrey Club 33: 199. 1906 *

This plant is very distinct from *T.* (*Aspidium*) *trifoliata*, with which it has been confused. The rootstocks are small (about 5 mm. in diameter and 2–6 cm. long) and prostrate, clothed at the growing end with narrow, lance-acuminate dark scales, the bases of which persist for several years. Contrary to the usual habit of ferns with horizontal rhizomes, the fronds arise from all parts of its surface, those beneath growing out laterally, then erect. The stipes are usually from one to two, rarely three decimeters long. They are slender and nearly naked, green or somewhat castaneous, especially near the base. They are slightly grooved on the edges, and puberulent on the upper surface near the top. The laminae are lance-ovate to triangular-ovate, acute or acuminate, about 6–15 cm. long and nearly as broad. They are herbaceous and dull, entirely lacking the beautiful gloss of the last species, and the upper surface is somewhat hairy-puberulent, most pronounced on the veins. When simple they have much the appearance of a maple leaf. Usually the basal lobes are distinct, with two or three lobes on the lower margin and the upper margin undulate. The apical lobe of the frond bears several usually obtuse lobes on each side, these passing to undulations towards the acuminate tip. The venation is similar to the last, but the paracostal areoles are usually without free veinlets. The indusia usually appear to be peltate because of the overlapping of the "full" basal lobes.

Sides of lime-sinks and neighboring lime rocks in all the hammocks of the Homestead region. Found also in Cuba and the Bahamas. At Ross's hammock I found a form with pentagonal fronds 2–2.7 dm. long, and 2 dm. wide, the lower pair of pinnae petioled and deeply lobed, the second pair cut to the rachis, the chief segments coarsely lobed. This appears to be an extreme form of the present species. This species differs from the last in the horizontal, small rootstocks, smaller size, outline of the fronds, the dull surface, the divergent rather than falcate lobes, the reniform indusia, the lack of veinlets in the paracostal areolations and the scarcity of free veinlets in the others.

ODONTOSORIA J. Smith

General habit of *Davallia* and sometimes considered as a section of that genus (§ *Stenoloma* Fée; *Cuneatae* Hook.).

Fronds mostly decompound, the ultimate segments narrow, cuneate, glabrous, with the sori sunk in a transverse pocket at the apex, much like the genus *Lindsaya*.

ODONTOSORIA CLAVATA (Sw.) J. Smith *

Rootstocks short, creeping, densely clothed with jointed filiform, glossy, dark-brown hair-like scales; stipes contiguous, stramineous, naked except for a few scales at the base, 3–25 cm. long, obtusely triangular; fronds 1–3 dm. long, 5–18 cm. wide, ovate to lanceolate, dichotomously tri-quadripinnate, the ultimate segments often cleft or divided; rachis stramineous, deeply grooved above; pinnae long-stalked; ultimate rachises green, centrally grooved; segments linear to cuneate, entire on sides, finely toothed at apex, about 1 cm. long and 1–2 mm. wide, with 1 or 2 usually dichotomously forked veins with thickened and confluent ends; sori sunk in the ends of the segments, confluent on a transverse vein that connects the tips of the primary veins.

On the edges of small lime-sinks which usually contain water, in pine woods; first observed by Mr. Simpson near Camp Jackson. Found later by Mr. Soar and myself in sinks between Costello's and Ross's hammocks, and later by me in an old well at Buena Vista. It is a very pretty fern, lining the sides of the sinks, thriving best where shaded from the direct sunlight. It is found only in those sinks that are in the comparatively strong light of the pine woods. Its yellowish-green, finely cut, close-set fronds hanging gracefully over the rugged rocks form a very pleasing sight. It is found in most of the West Indies, including the Bahamas, and it is not surprising that it should be found in the lime-rock regions of South Florida.

NEPHROLEPIS BISERRATA Schott

Abundant in swampy hammocks back of Miami and in similar situations southward, often on palmettos. In Costello's hammock is an opening overrun by this fern, through which it is impossible for one to force his way, except by bending the plants down and

walking over them; the tangle being so dense that it will support the weight of a man. In favorable localities the fronds attain a length of 3 to 3.6 meters.

NEPHROLEPIS EXALTATA Schott

Mostly on palmettos but often on the ground in drier situations than the last, much smaller in size. Very common in hammocks.

SALVINIACEAE

AZOLLA CAROLINIANA Willd.

Collected only once, in a ditch at Sanford, and seen once from a car window in east central Florida. Apparently absent from the lower counties.

LYCOPODIACEAE

LYCOPODIUM CAROLINIANUM L.

In damp sand bordering a swamp at Fort Lauderdale, in company with *L. adpressum*; resting in December. In a sandy swamp at Sanford, with immature spikes June 1. In the autumn the tips of the stems elongate and penetrate the earth to the depth of 1 cm. or more, then thicken into scaly rootstocks 1 to 2 cm. long, from the end of which a shoot arises in spring to continue the growth.

LYCOPODIUM CERNUUM L.

Only one specimen seen from a car window on the damp borders of a stream at Nocatee.

LYCOPODIUM ADPRESSUM (Chapm.) Underw.

First found at Fort Lauderdale in November, in a ditch by the railroad. I subsequently found a little at Orange Glade near Miami, and another place along the river above Fort Lauderdale. It was plentiful in a swampy field at Fort Myers, where it bore abundant flabellate or decompound sterile peduncles in June. Apparently confined to the borders of swamps in sandy regions. I saw no *L. alopecuroides* in South Florida.

PSILOTUM NUDUM (L.) Griseb.

Not uncommon in decaying vegetable matter, often at the bases of palmetto trees. It grows most luxuriantly in decayed places in prostrate logs or living trees, sometimes at an altitude of 5 meters. Some specimens obtained at Costello's hammock are 4.5 dm. high and 3 dm. broad.

SELAGINELLA RHODOSPORA Baker*

§ *Apodae.* Tufts small; plant annual, pinnate, 1–3 cm. long; branches short, 2 mm. broad; under leaves spaced or slightly imbricated, 1.75–2 mm. long by 0.75 mm. broad, obliquely oblong, the upper edge more rounded, apiculate, finely papillose over the upper surface, each margin with 14–18 minute bristle-like teeth; upper leaves lanceolate, long acuminate, appressed to the stem, 1 mm. long, 0.25 mm. broad, with about 7 setae on each side; spikes 2–5 mm. long; sporophyls 1.6 mm. by 0.57 mm., ovate-lanceolate, abruptly long-acuminate and ending in a rough awnlike point, the edges slightly hyaline and with 15–18 bristles, the under ones broader, divaricate and fructiferous, the upper darker green and sterile, keeled and bristled on the back towards the apex; gynospores reddish-orange, 22 μ in diameter, coarsely tubercled; androspores not seen.

A very delicate little species growing among the algae on the borders of pot-holes on the edges of the prairies, where inundated most of the year. Black Point bridge and beside a prairie below Homestead, in November and December. Evidently only collected once before, in eastern Cuba, by Wright. This has been erroneously referred by Gilbert * to *S. caribensis* Jenman.

SELAGINELLA ARENICOLA Underw.

Common in the sandy pine woods about Alapattah, but apparently absent from the rocky woods from Miami southward.

ISOETACEAE

ISOETES FLACCIDA Shuttlew.

Rich soil, border of everglade at Orange Glade, border of the north fork of the Miami at the rapids, and in the brook at Snapper

* Fern Bull. 13: 74.

hammock, in November, scarce. In a muddy, shaded alligator hole in the pine woods at Gossman's; abundant in February. Plentiful in low places near a swamp at Fort Ogden, in March.

AMES BOTANICAL LABORATORY,
NORTH EASTON, MASSACHUSETTS.

The behavior of the pollen-tube in Houstonia coerulea

CHESTER ARTHUR MATHEWSON

The present study was undertaken at the instance of Professor F. E. Lloyd during the past winter, and prosecuted in the laboratory of Teachers College with his assistance and under his direction. My work, the material for which was collected in the neighborhood of Mt. Holyoke, Mass., in the summer of 1904, has thus far been confined to one species, *Houstonia coerulea.*

METHODS

Both young and old flowers were collected and fixed in Flemming's fluid, chromo-acetic solution, and alcohol-acetic solution. With the tissue that had been fixed in the first two I used the Flemming triple stain. The tissue fixed in alcohol-acetic solution was stained with iron-alum haematoxylin and Bismarck brown. The latter method has thus far yielded the best results. All the sections were cut 10 μ thick.

RESULTS OBTAINED FROM ALLIED FORMS

In connection with his work on the embryology of the *Rubiaceae*, Lloyd has studied the pollen-tube in two genera — *Richardsonia* and *Diodia.* Briefly stated, his results show that in *Richardsonia pilosa* and in *Diodia teres* the course of the pollen-tube is chiefly intercellular, while in *D. virginiana* the pollen-tube grows freely in the cavity of the ovary. Since the behavior of the tube is so different in two closely related species of the same genus, and likewise in two closely related genera of the same family, Lloyd agrees with Murbeck that the phenomenon is a matter of physiological meaning only, and disagrees with Treub and Nawaschin in their contention that the intercellular mode of growth is of importance from a phylogenetic point of view. It will be remembered in this connection that Longo, as a result of his studies in the Cucurbitaceae, has come to conclusions similar to those of Lloyd. I may add that my own results seem to add further evidence in support of this view.

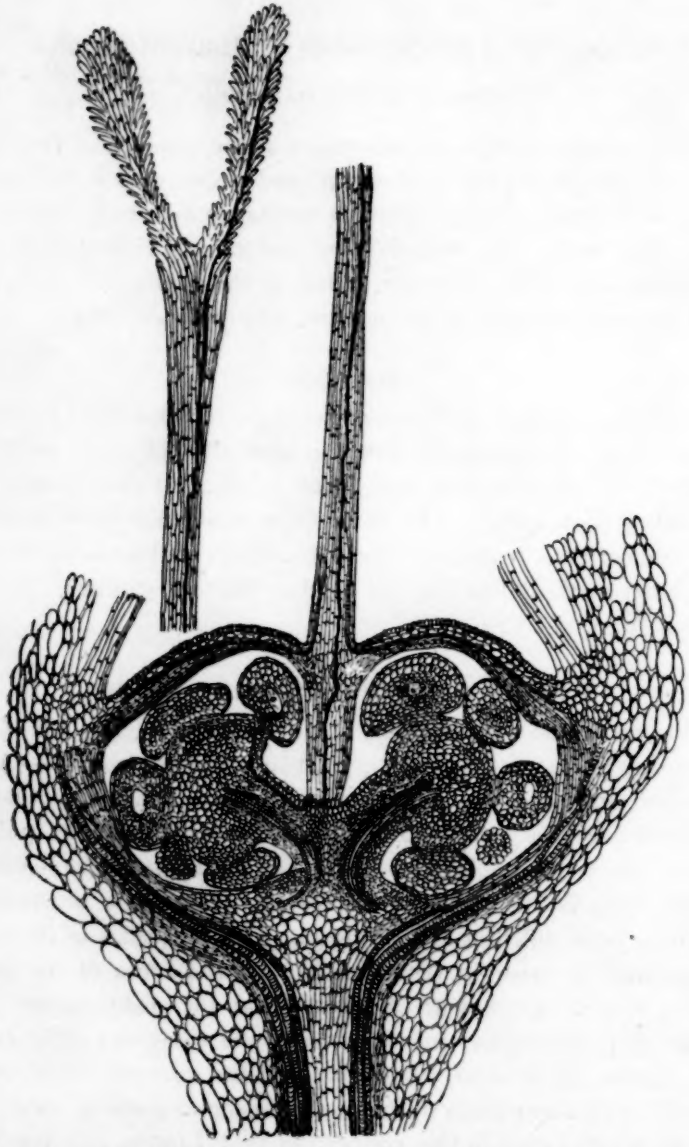

FIG. 1. Longitudinal section of the pistil of *Houstonea coerulea*, showing the course of the pollen-tube from the stigma to an embryo-sac, at its egg pole.

HISTOLOGY

In *Houstonia coerulea* there is a bilocular inferior ovary 1.9 mm. wide in its longer axis, and about 1.3 mm. deep (figure 1). The locules, as in the case of *Diodia* and *Richardsonia*, are separated by a partition of two portions. The lower portion arises, as Lloyd has shown, from the floor of the ovary. The original single ridge gives rise to two club-shaped placentae, one in each locule. Each placenta soon begins to show a number of protuberances — the primordia of the ovules. The style is single, with two stigmas, and arises by the concrescence of two ridge-like fundaments which develop laterally and opposite to each other on the inside of the hollow torus. During this concrescence a transverse ridge is formed on the inside of the ovary roof which by growing downward until it meets the ridge arising from the floor, ultimately divides the originally single ovarian chamber into two locules. The main point concerning the ovule is that there is no integument whatever at any stage, and as a result the micropyle is entirely wanting. The ovules, usually at least 15 in each locule, are very small, averaging about 70 μ long by 60 μ deep. They are when mature somewhat bowl-shaped with the concave side toward the placenta. The funicle is very short. The ovule conforms, broadly speaking, to the campylotropous type. The embryo-sac lies buried about midway in the ovule with its slightly curved longer axis at right angles with the funicle, coincident with the longer axis of the ovule.

BEHAVIOR OF THE POLLEN-TUBE

The two stigmas are furnished with numerous club-shaped papillae (figure 1), which are found over their entire surfaces. These papillae are formed by the outward bending of superficial cells. The pollen-grains average 15 to 17 μ in diameter, and are about twice the diameter of the papillae. They have numerous germ-pores.

As a rule the tube emerges from the pollen-grain on the side toward the papilla, but there are many exceptions to this. In some cases the pollen-tubes have been observed to emerge through a germ-spot diametrically opposite to the point of contact with the stigma, growing down upon the surface of the grain

and so reaching the hair. In a similar case the tube grew out toward the adjacent papilla and pursued its way thereon instead of on the one with which the grain was in contact. Strasburger figures cases in *Agrostemma* and *Malva* in which the tube enters the papillary cell and pursues its way within, but I have found no evidence that this occurs in the form I have studied. Growth on the papilla is entirely superficial. The tube very often makes one, or even two full turns around a papilla before it reaches the base, a condition precisely like that described by Strasburger in the case of one of the grasses, *Alopecurus pratensis*.

Arrived at the base of the papilla the tube begins its intercellular course. The papillae merge at their bases with long, narrow relatively thin-walled cells, the first kind of conductive tissue which it meets in its course. There are no intercellular spaces whatever in the tissues traversed by the tube. The width of the pollen-tube varies from 2 to 4 μ. It seems quite probable that the method by which the tube first penetrates between the cells of the epidermis of the stigma is the method by which it is able to force its way throughout its entire course. It is well known that the pollen-tube is capable of secreting a cellulose-dissolving enzyme, and it seems that we should be safe in saying that by breaking down the middle lamella between the cells with which it comes in contact the slender tube of this species makes room for its growth. The tube is doubtless nourished, in part at least, by the absorption of the cellulose which has been converted into available food by its enzymes. The width of the tube is not constant, usually being somewhat greater in its younger portion than farther back, where it becomes collapsed. The vascular elements of the style are in two small bundles which are always farther from the middle of the style than the pollen-tubes. Little or no distortion or other bad effect results from the contact of the pollen-tube with the cells along its course. If the tube meets a cell lying directly across its path it simply passes around it.

At the level of the roof of the ovary the pollen-tube encounters a tissue, the cells of which are more irregular and the walls thicker (figure 1). Some of the cells are quite short. The tube goes on down through this stylar portion of the ovarian partition as readily as through the part above. Anatomically there appears

no reason why it should not make its way into the cavity of the ovary directly after reaching this tissue, but it appears that it never does so.

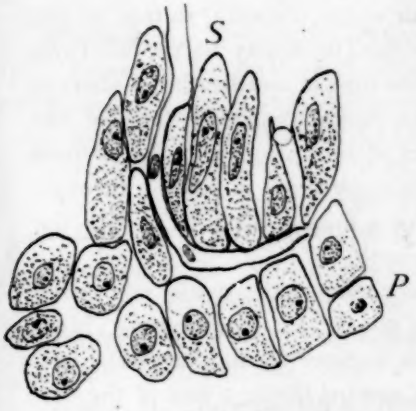

FIG. 2. Contact of stylar tissue (*S*) with the basal element of the ovary-partition (*P*), showing the turn made by the pollen-tube on reaching the latter.

At the place where the stylar elements blend with the basal elements of the partition the tube encounters a third kind of tissue which is in sharp contrast with those heretofore traversed. Its course appears to be interrupted by relatively shorter, columnar cells with thicker walls beneath which are parenchymatous cells. On reaching this tissue the tube invariably makes a sharp turn to the right or left (figure 2), and thus enters the stalk of one of the two placentae. It often happens that this turn takes the tube directly toward the surface of the placenta, and in such a case the tube makes a further turn which carries it beneath the epidermis (figure 3). In no case does it approach nearer than within one cell-layer of the surface. Large cellulose plugs (figure 3), twice the diameter of the pollen-tube itself, are often seen in this region. They also occur quite often in the style.

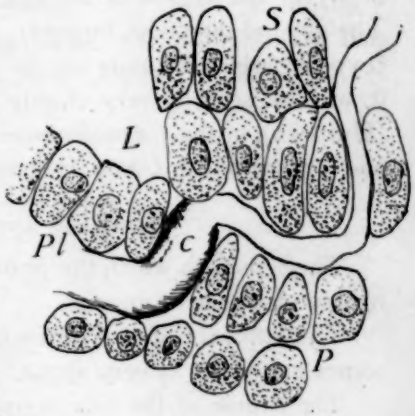

FIG. 3. Basal portion of placental stalk (*Pl*) and adjacent tissue (*P*) of the basal partition, with a part of the stylar tissue (*S*) abutting on the latter. *C*, cellulose plug in the pollen-tube, which at this point turns in order to penetrate the placental stalk. *L*, locule.

The pollen-tube continues its course through the placenta either immediately below the epidermis or from one to several cell-rows below it. This tissue is composed of approximately

isodiametric cells and the path of the tube in it may be straight or subject to sudden variations. As the tube approaches the ovule it usually grows toward the interior of the placenta, so that by the time it reaches the region of the funicle, it may be six cell-rows below the surface. The cells of the funicle constituting a scission layer, are much smaller than the parenchymatous cells of the placenta and have their long axes at right angles to the path of the tube. The tube usually makes many turns in passing through this tissue. It may even grow for a minute distance across the sinus between the funicle and the ovule.

The tube has now reached the tissue of the ovule, composed of small thin-walled cells, and its course, as in *Alchemilla* (Murbeck), in the region of the egg is subject to sudden deviations. The general direction, however, is toward the egg end of the embryo-sac, which it finally reaches. The course of the pollen-tube, it will be seen, is very closely analogous to that in *Alchemilla* (Murbeck), in the *Cannabinaceae* (Zinger), in *Cynomorium* (Pirotta and Longo), and in *Ulmus* (in some instances studied by Nawaschin).

SUMMARY AND CONCLUSIONS

The cells with which the pollen-tube comes in contact influence it only in a passive manner.

The influence of the pollen-tube upon the cells with which it comes in contact is very slight.

The course of the tube seems to support the hypothesis that has been advanced that a chemotactic stimulus originating in the egg-apparatus, or the egg itself, is the chief directive influence.

The endotropic phenomenon here set forth adds another link in the chain of evidence that the intercellular mode of growth is purely a physiological phenomenon, and not a character inherited from more primitive forms.

LITERATURE

Lloyd, F. E. Comparative embryology of the Rubiaceae. Mem. Torrey Club **8**: 1–26. 1899; 27–112. 1902.

—— The pollen-tube in the Cucurbitaceae and Rubiaceae. Torreya **4**: 86–91. 1904.

—— The course of the pollen-tube in *Houstonia*: a preliminary note. Torreya **5**: 83–85. 1905.

Longo, B. Richerche sulle Cucurbitaceae e il significato del percorso intercellulare (endotropico) del tubetto pollinico. R. Accad. Lincei V. **6**: 523–547. 1903.

Murbeck, S. Ueber das Verhalten des Pollenschläuches bei *Alchemilla arvensis*. Lunds Univ. Årsskrift **36** (2)[9]: 1–18. 1901.

Nawaschin, S. Ueber die gemeine Birke (*Betula alba* L.) und die morphologische Deutung der Chalazogamie. Mém. Imp. Acad. Sci. St. Petersb. VII. **42**: —. 1894.

—— Ueber das Verhalten des Pollenschläuchs bei der Ulme. **Bull.** Imp. Acad. Sci. St. Petersb. V. **8**: 345. 1898.

Strasburger, E. Neue Untersuchungen ueber den Befruchtungsvorgang bei den Phanerogamen. Jena 1884.

Treub, M. Sur les Casuarinées at leur place dans le système naturel. Ann. Jard. Buit. **10**: 145–231. 1891.

Zinger, N. Beiträge zur Kenntniss der weiblichen Blüthen und Inflorescenzen bei Cannabineen. Flora **85**: 189–253. 1898.

Studies in the North American Convolvulaceae, II. The genus Operculina

Homer Doliver House

The original description of the genus *Operculina* S. Manso was based upon the operculum-like structure, quatrefoil in shape, which tops the capsule in the type species — *O. macrocarpa* Urban. An examination of a large number of specimens of this and related species shows that the presence of an operculum is not in this case a generic distinction, for often of two species closely and evidently related by all other characters, one will have a well developed operculum and the other none or sometimes in a few specimens, only vestiges of one. While the type has irregular dehiscence some other species with an operculum have a valvular dehiscence to the capsules.

The common features, however, that do occur throughout a considerable group of species that seem by a preponderance of characters to center congenerically about the type of *Operculina* are as follows: the pear-shaped calyx, rounded at the base and narrowed above; the large imbricated sepals more or less chartaceous or parchment-like in fruit; the broadly campanulate-funnelform tube of the corolla, and the strongly contorted anthers which are often protruding from the tube of the corolla. The capsules are usually large and thin-walled, often the upper hemisphere of the capsule thicker than the lower.

This extension of the genus seems to be the only satisfactory way to place properly those species variously assigned to *Merremia*, *Batatas*, and *Ipomoea*, with spirally-twisted anthers and other characters in common with species now placed in *Operculina*.

OPERCULINA S. Manso, Enum. Subst. Bras. 16. 1836

Twining plants with woody or herbaceous, perennial stems, entire or divided leaves. Stems or peduncles often more or less winged. Calyx large, pear-shaped, constricted above, the closely imbricated sepals scarious or chartaceous and often colored,

usually enlarged in fruit. Corolla campanulate, campanulate-funnelform, or sub-salverform. Stamens included or protruding, the anthers spirally twisted. Disk hypogynus or obsolete. Ovary 2-celled, 4-ovuled. Capsules large, often extremely so, 2-celled and usually 4-seeded, or partially 4-celled, usually differentiated into an upper thicker and a lower thinner portion, or the thin-walled capsule covered by an operculum-like, quatrefoil cap which is deciduous at maturity. More rarely, the capsule of uniform texture and valved; the dehiscence transverse or irregular. Seeds large, black or brown and usually smooth.

Type species: *Operculina Convolvulus* S. Manso, *l. c.* (*Convolvulus macrocarpus* L., *O. macrocarpa* Urban). About 20 species of tropical distribution.

Turpithum Raf. Fl. Tellur. **4**: 71. 1836.

Spiranthera Boj. Hort. Maurit. 226. 1837. Not *Spiranthera* A. St. Hil. 1823.

Piptostegia Reichenb. Nom. 113. 1841. — Hoffmannsegg, in Mart. Syst. Mat. Med. Veg. Bras. 78. 1843.

Ipomoea § *Operculina* Griseb. Fl. Br. W. Ind. 467. 1861.

Key to the North American species

Leaves entire.
- Stems conspicuously winged.
  - Stems glabrous; corolla yellow, 4–5 cm. long. 1. *O. alata.*
  - Stems pubescent or pilose.
    - Corolla white; peduncles exceeding the subtending petioles. 2. *O. triquetra.*
    - Corolla violet; peduncles shorter than the subtending petioles. 3. *O. leptoptera.*
- Stems not winged; peduncles usually winged.
  - Corolla white or cream-colored; leaf-blades deeply cordate, 10–30 cm. long. 4. *O. ventricosa.*
  - Corolla not white; leaf-blades shallowly-cordate, rarely more than 10 cm. long.
    - Corolla yellowish; peduncles obscurely or not at all winged, 1–2-flowered. 5. *O. rhodocalyx.*
    - Corolla scarlet or salmon-colored; peduncles conspicuously winged.
      - Corolla scarlet; peduncles 1–3-flowered. 6. *O. rubicunda.*
      - Corolla salmon-colored; peduncles flexuose, 2–7-flowered. 7. *O. alatipes.*

Leaves lobed or divided.
- Stems winged; corolla white. 8. *O. macrocarpa.*

Stems not winged.
Corolla yellow; sepals 3 cm. long or longer; capsule 3–4 cm. in diameter. 9. *O. tuberosa.*
Corolla white or whitish; sepals smaller; capsules 1–2 cm. in diameter.
Leaves pinnately lobed or, if palmately lobed, not cut to the petiole.
Leaves palmately lobed, the segments much toothed or cut; petioles and stem hispid. 10. *O. dissecta.*
Leaves pinnately lobed; plant glabrous.
Lobes lanceolate or broader, with undulate margins. 11. *O. Roseana.*
Lobes linear, margins entire. 12. *O. angustiloba.*
Leaves palmately lobed to the petiole.
Plant glabrous.
Leaflets lanceolate, acuminate. 13. *O. Palmeri.*
Leaflets elliptical-oblong, obtuse. 14. *O. platyphylla.*
Sepals and stems hispid. 15. *O. aegyptia.*

1. OPERCULINA ALATA (Ham.) Urban, Symb. Ant. **3**: 343. 1902.

Convolvulus alatus Ham. Prodr. Fl. Ind. Occ. 24. 1824.

Ipomoea Hamiltoni G. Don, Gen. Syst. **4**: 268. 1838.

Ipomoea pterodes Choisy, in DC. Prodr. **9**: 361. 1845. — Griseb. Fl. Br. W. Ind. 467. 1861.

Ipomoea altissima Mart.; Choisy, *l. c.* 359.

Operculina pterodes and *O. altissima* Meissn. in Mart. Fl. Bras. **7**: 313. 1869.

Ipomoea alulata Miquel, Linnaea **18**: 599. 1844.

Operculina populifolia Hallier f. Bot. Jahrb. **16**: 550. 1893. (Ex spec. Wright *no. 3083.*)

Type locality: Near Scarborough, Tobago.

Distribution: Cuba and the Lesser Antilles, northern coast of South America and adjacent islands.

Illustrations: Mart. Fl. Bras. **7**: *pl. 75.*

2. OPERCULINA TRIQUETRA (Vahl) Hallier f. Bot. Jahrb. **18**: 120. 1894

Convolvulus triquetra Vahl, Symb. **3**: 30. 1794. — Schlecht. Linnaea **6**: 738. 1831.

Ipomoea triquetra Roem. & Schultz, Syst. **4**: 231. 1819. — Choisy, in DC. Prodr. **9**: 360. 1845, excl. syn. Ham. & G. Don.

Type locality: St. Croix.

Distribution: Lesser Antilles (St. Croix, St. Thomas, Santa Cruz and Tobago), Venezuela, Guiana, and Brazil.

3. OPERCULINA LEPTOPTERA Urban, Symb. Ant. **3**: 342. 1902

Type locality: Hateurs des Trois Islets, *Père Duss 426* (type).

4. OPERCULINA VENTRICOSA (Bert.) Peter, in Engl. & Prantl, Nat. Pfl. **4**[3a]: 32. 1891

Convolvulus ventricosus Bert. in Colla, Hort. Ripul. 37. 1824. Not *C. ventricosus* S. Manso, 1836.

Ipomoea ventricosa G. Don, Gen. Syst. **4**: 274. 1838.—Choisy, in DC. Prodr. **9**: 360. 1845.

Type locality: St. Bartholomew.

Distribution: Lesser Antilles; Martinique, Antigua; French and Swedish Islands; Guadeloupe, St. Bartholomew, etc.

Illustrations: Jacq. Vind. **3**: *pl. 69*.

5. **Operculina rhodocalyx** (A. Gray)

Ipomoea rhodocalyx A. Gray, Proc. Am. Acad. **22**: 439. 1887.

Type locality: "At base of hills, Tequila, Jalisco [Mexico], Palmer No. 421, 1886" (type).

6. **Operculina rubicunda** nom. nov.

Ipomoea alata J. N. Rose, Contr. Nat. Herb. **1**: 108. 1891. Not *I. alata* R. Br. 1810; nor *I. alata* G. Don, 1838. Not *Operculina alata* (Ham.) Urban.

Similar in habit to *O. alatipes* and *O. rhodocalyx*. Leaf-blades thin, triangular-ovate, 3–8 cm. long, shallowly cordate, entire, acuminate; petioles shorter than the blades: peduncles exceeding the subtending petioles, broadly 2-winged below the middle, 1–3-flowered; pedicels 1.5–2 cm. long, clavately thickened and angled, somewhat deciduous in fruit: sepals membranaceous, acute, 2.5 cm. long, the outer ones more or less tinged with brick-red: corolla subsalverform, scarlet, the tube about 5 cm. long and 1 cm. in diameter, the limb 2.5–3 cm. broad, the spirally twisted anthers equaling the tube or barely protruding: capsules globose, 1.5 cm. in diameter, 2-celled, 4-seeded; seeds black, glabrous, 6 by 8 mm.

SONORA: Alamos, *Dr. E. Palmer 706*, Sept. 16–20, 1890, type, n the National Herbarium.

Ymala, *Dr. E. Palmer 1709*, Sept. 25–Oct. 8, 1891.

MICHOACAN: Real de Guadalupe, *E. Langlassé 352*, Sept. 12, 1898.

Differs from *O. rhodocalyx* by its less cordate, thinner and more triangular leaf-blades, winged peduncles and scarlet corollas; from *O. alatipes*, by its more slender habit, fewer-flowered infloresence, and smaller scarlet corollas.

7. **Operculina alatipes** (Hook.)

Ipomoea pterodes Seem. Bot. Voy. Herald 171. 1854. Not *I. pterodes* Choisy, 1845; nor *I. pterodes* Griseb. 1861.

Ipomoea alatipes Hook. Bot. Mag. *pl. 5330*. 1862.

The stout peduncles curved, broadly 2-winged below the middle, 2–7-flowered and strongly flexuous between the pedicels, the pedicels secund and upright, thickened: calyx 2.5 cm. long: corolla subsalverform, 6–7 cm. long, salmon-colored, the limb 4.5–5 cm. broad, with five obscure, rounded lobes.

Distribution: Southern Mexico to Columbia.

8. OPERCULINA MACROCARPA (L.) Urban, Symb. Ant. **3**: 343 1902

Convolvulus macrocarpus L. Syst. ed. 10. 923. 1759. — Sp. Pl. ed. 2. 222. 1762.

Convolvulus operculatus Gomes, Mem. Acad. Lisb. **3**: App. 27. 1812.

Ipomoea operculata Mart. in Spix & Mart. Reise Bras. **2**: 547. 1828. — Choisy, in DC. Prodr. **9**: 361. 1845.

Operculina Convolvulus S. Manso, Enum. Subst. Bras. 12. 1836. — Meissn. in Mart. Fl. Bras. **7**: 211. 1869.

Type locality: America.

Distribution: Antilles and tropical South America.

Illustrations: Plum. Am. *pl. 91. f. 1*. Gomes, *l. c. pl. 3*. Mart. Fl. Bras. **7**: *pl. 74*.

9. OPERCULINA TUBEROSA (L.) Meissn. in Mart. Fl. Bras. **7**: 212. 1869.

Ipomoea tuberosa L. Sp. Pl. 160. 1753; ed. 2. 227. 1762; excl. syn. Plukn. — Choisy, in DC. Prodr. **9**: 362. 1845, excl. syn.

Convolvulus gossypiifolius Spreng. Syst. **1**: 592. 1825.—Schlecht. Linnaea **6**: 742. 1831.

Convolvulus tuberosus Spreng. *l.c.* Not *C. tuberosus* Vell.

Ipomoea kentrocaulos C. B. Clarke, in Hook. Fl. Brit. Ind. **4**: 213. 1874; excl. syn. Steud.

Ipomoea nuda Peter, in Engl. & Prantl, Nat. Pfl. **4**^{3a}: 31. 1891.

Type locality: Jamaica.

Distribution: Cuba, Jamaica, St. Domingo and other West Indian islands, Central America, tropical South America and the old world.

Illustrations: Sloane, Jam. **1**: *pl. 96. f. 2.* Bot. Reg. *pl. 768* (white flowers probably an error).

10. **Operculina dissecta** (Jacq.)*

Convolvulus dissectus Jacq. Obs. **2**: 4. 1767.—L. Mant. 204. 1771.

Ipomoea sinuata Ortega, Hort. Matr. Dec. 84. 1798.

Ipomoea dissecta Pursh, Fl. Am. Sept. 145. 1814. Not *I. dissecta* Willd. 1794, nor *I. dissecta* R. Br. 1810.

Ipomoea subpedata Desf. Cat. Hort. Par. ed. 3. 397. 1829.

Ipomoea nigricans Gardn. Lond. Jour. Bot. **1**: 180. 1842.

Merremia dissecta Hallier f. Bot. Jahrb. **18**: 114. 1894.

Type locality: America.

Distribution: Florida and Texas; Mexico, West Indies and tropical South America.

Illustrations: Jacq. Obs. **2**: *pl. 28*; Hort. Vindob. *pl. 159*.

11. **Operculina Roseana** sp. nov.

Low, extensively twining among bushes, 1–3 m. long, glabrous: leaf-blades ovate in outline, 4–7 cm. long, pinnately parted into 5

* The *Ipomoea dissecta* Willd. and R. Br. of the old world has often been confused with the American plant both on account of the homonymous name and their strong relationship. It cannot be consistently kept in a different genus but belongs to *Spiranthera* of Bojer, which is not separable from *Operculina* by any constant character.

Operculina coptica (L.)

Convolvulus copticus L. Mant. 559. 1771.

Ipomoea dissecta Willd. Phyt. 5. *pl. 2. f. 3.* 1794.—Sp. Pl. **1**: 880. 1798.—R. Br. Prodr. 487. 1810.

Ipomoea coptica Roth, Nov. Pl. Sp. 110. 1821.—Choisy, in DC. Prodr. **9**: 384. 1845.

Tropical Africa, Asia, East Indies, and Australasia.

lanceolate lobes, the lobes contracted below the middle, the margins undulate or subsinuately toothed, the middle lobe longest, broadest below the middle and tapering to an acute or acuminate apex, two of the lateral lobes arising from near the base of the middle lobe, the other two entirely basal and often again somewhat 1–2-lobed on the outer margin; petioles shorter than the blades: peduncles 3–6 cm. long, 1-flowered; pedicels about 2 cm. long, thickened above, especially in fruit, sharply angled but not winged: sepals equal, 1–1.5 cm. long, oval or oblong, rounded at the apex, margins scarious: corolla campanulate-funnelform, yellowish-white, about 3 cm. long, the limb as broad, silky-hirsute on the plicae without with blackish hairs, densely so in bud, the strongly contorted anthers protruding or inserted: capsules globose, 1.5 cm. in diameter, topped by a quatrefoil, deciduous operculum, with rounded lobes, thick and coriaceous in texture, the walls of the capsules thin and submembranaceous, semitranslucent.

SONORA: Agiabampo, *Dr. Edward Palmer 781*, 1894, type, in the National Herbarium, sheets *no. 208789* and *208790*.

MORELOS: Puenta de Ixtla, *Rose & Hay 5320*, July 4, 1901.

CHIAPAS: San Vicente, *Goldman 871*, April 20, 1904.

The three specimens seen indicate a most remarkable range, and the species will undoubtedly be found in many intervening localities. The specimens from Morelos and Chiapas have the lobes of the leaf-blades relatively shorter and broader than the type specimens from Sonora. The leaf-outline is strikingly odd and not closely simulated by any other known species of *Operculina*, except the next which may prove to be but an extremely narrow-lobed variety of *O. Roseana*.

Operculina Roseana was described without name, in Contr. U. S. Nat. Herb. **1**: 344. 1895, by Dr. J. N. Rose, for whom it is now named.

12. **Operculina angustiloba** sp. nov.

Similar to *O. Roseana*, but more slender; leaf-blades more elongate in outline, primarily 3-lobed, the middle lobe with 2 lateral lobes at or near its base, the lobes linear, entire, somewhat emarginate, the middle lobe 3–5 cm. long, 1.5–2 cm. wide, the lateral lobe 0.5–3 cm. long and usually narrower than the middle lobe with small lateral segments near the middle in addition to those at the base: peduncles 6–8 cm. long, bracts linear-lanceolate, 5–6 mm. long; pedicels thickened above, 2.5–4 cm. long: sepals 10–13 mm. long, greenish, tinged with purple above: cor-

olla-limb somewhat broader than *O. Roseana*, 4–5 cm. broad, the margin subentire, the plicae hirsute without with black hairs.

SAN LUIS POTOSI: San Dieguito, *Dr. Edward Palmer 112*, June 13–16, 1904; type in the National Herbarium.

13. **Operculina Palmeri** (S. Wats.)

Ipomoea Palmeri S. Wats. Proc. Am. Acad. **24**: 63. 1889.

Type locality: Guaymas, Sonora [Mexico], *Dr. Edward Palmer 75*, 1887 (type).

Distribution: Stream beds and ravines, Sonora, Mexico.

14. **Operculina platyphylla** (Fernald)

Ipomoea Palmeri platyphylla Fernald, Proc. Am. Acad. **33**: 90. 1897.

Resembling *O. Palmeri*, but the stems smoother, leaflets broader, more obtuse at the ends; peduncles often many-flowered; corolla longer than in *O. Palmeri*.

Type locality: Acapulco, Guerrero [Mexico], *Dr. Edward Palmer 415*, 1894–95 (type).

15. **Operculina aegyptia** (L.)

Ipomoea aegyptia L. Sp. Pl. 162. 1753.
Convolvulus pentaphyllus L. Sp. Pl. ed. 2. 233. 1762.
Ipomoea pentaphylla Jacq. Coll. **2**: 297. 1788.
Ipomoea pilosa Cav. Ic. **4**: 11. 1797. Not *I. pilosa* Sweet.
Convolvulus nemorosus Willd. in R. & S. Syst. **4**: 303. 1819.
Spiranthera pentaphylla Bojer, Hort. Maurit. 226. 1837.
Batatas pentaphyllus Choisy, Conv. Or. 54. 1834. — In DC. Prodr. **9**: 339. 1845.

Type locality: Tropical America.

Distribution: West Indies; central and southern Mexico to Brazil and Peru. Tropics of the old world.

Illustrations: Herm. Lugdb. *pl. 185*. — Jacq. Coll. **2**: *pl. 319*. — Wight, Ill. Ind. Bot. *pl. 7*. — Cav. Ic. **4**: *pl. 323*. — Wight, Ic. *pl. 834*.

The commonly accepted name for this species, *Ipomoea pentaphylla* (L.) Jacq., is plainly antedated by the Linnaean name *I. aegyptia*. Linnaeus did here what he frequently did in the case

of other species, *i. e.*, he changed the name of the species in the second edition of the Species Plantarum from that of the first edition. The two Linnaean names are shown to be synonymous by the same pre-Linnaean citations given under both.

In addition to the fifteen species of North America the following two species are found on the western coast of tropical South America and may occur in Central America:

Operculina ampliata (Choisy)

Ipomoea ampliata Choisy, in DC. Prodr. **9**: 361. 1845.
Type locality: "Campeche, ins. oceani Pacifici."

Operculina codonantha (Benth.)

Ipomoea codonantha Benth. Pl. Hartw. 120. 1843.
Type locality: "In sylvis prope Guayaquil."

SPECIES INQUIRENDAE

Operculina Pavoni Hallier f. Bot. Jahrb. **16**: 550. 1893. "Nova Hispania; Pavon, in herb. Boiss."

INDEX TO AMERICAN BOTANICAL LITERATURE
(1906)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers, at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card-issue should be addressed to the Treasurer of the Torrey Botanical Club.

Abrams, L. R. Two new southwestern species of *Pentstemon*. Bull. Torrey Club **33**: 445, 446. 30 Au 1906.

Arthur, J. C. Eine auf die Struktur und Entwicklungsgeschichte begründete Klassifikation der Uredineen. Result. Sci. Congr. Internat. Bot. Wien 331–348. 1906.

Includes diagnoses of 16 new genera.

Arthur, J. C. & Kern, F. D. North American species of *Peridermium*. Bull. Torrey Club **33**: 403–438. 30 Au 1906.

Thirty species are recognized, of which 10 are described as new.

Bay, J. C. Contributions to the theory and history of botanical bibliography. Bibl. Soc. Am. Proc. **1**: 75–83. Ap 1906.

Berry, E. W. Living and fossil species of *Comptonia*. Am. Nat. **40**: 485–520. *pl. 1–4*. 11 Jl 1906.

Blanchard, W. H. Two new and somewhat anomalous blackberries. Torreya **6**: 117–120. 20 Je 1906.

Rubus permixtus sp. nov. and *R. frondisentis* sp. nov.

Blanchard, W. H. Two new dewberries of the *Hispidus* group. Torreya **6**: 147–149. 25 Jl 1906.

Rubus jacens sp. nov. and *R. cubitans* sp. nov.

Britton, E. G. Notes on nomenclature VI. Bryologist **9**: 37–40. 3 My 1906. [Illust.]

Britton, N. L. *Galactia Odonia* Griseb. Torreya **6**: 149. 25 Jl 1906.

Buchenau, F. *Juncaceae.* Das Pflanzenreich 4^{36}: 1–284. *f. 1–121.* 15 My 1906.

Campbell, D. H. Germination of the spores of *Ophioglossum.* Ann. Bot. **20**: 321. Jl 1906.

Campbell, D. H. Multiple chromatophores in *Anthoceros.* Ann. Bot. **20**: 321. Jl 1906.

Cockerell, T. D. A. The fossil fauna and flora of the Florissant (Colorado) shales. Univ. Colo. Stud. **3**: 157–176. *f. 1–7.* Je 1906.

Collins, F. S. New species, etc., issued in the Phycotheca Boreali-americana. Rhodora **8**: 104–113. 28 Je 1906.

Collins, F. S. Notes on algae,—VII. Rhodora **8**: 122–126. 28 Jl 1906.

Collins, J. F. Mounting mosses—some hints. Bryologist **9**: 60–63. 2 Jl 1906.

Collins, J. F. Preliminary lists of New England plants,—XIX. Rhodora **8**: 131–135. 28 Jl 1906.

Buxbaumiaceae, Georgiaceae, Polytrichaceae.

Cook, M. T. Tropical epiphytes. Plant World **9**: 192–194. *f. 28.* [S] 1906.

Cushman, J. A. New England desmids of the sub-family *Saccodermae.* Bull. Torrey Club **33**: 343–351. 20 Jl 1906.

With new species and varieties in *Gonatozygon, Spirotaenia, Mesotaenium,* and *Cylindrocystis.*

Dalla Torre, K. W. von & Harms, H. Genera *Siphonogamarum* ad systema Englerianum conscripta. 8: 561–640. 1906.

Davenport, E. B. The apetalous form of *Arenaria groenlandica* on Mt. Mansfield. Rhodora **8**: 114. 28 Je 1906.

Douglas, G. E. The rate of growth of *Panaeolus retirugis.* Torreya **6**: 157–165. *f. 1–4.* 25 Au 1906.

Eastwood, A. The earthquake and the California Academy of Sciences. Torreya **6**: 120–123. 20 Je 1906.

Farr, E. M. Some new plants from the Canadian Rockies and Selkirks. Ottawa Nat. **20**: 105–111. 15 Au 1906.

New species are described in *Pachystima* (3), *Arnica, Hieracium, Dryas,* and *Ranunculus.*

Fernald, M. L. The identity of *Eriophorum Chamissonis* and *E. russeolum.* Ottawa Nat. **20**: 62–65. 4 Je 1906.

Fernald, M. L. A new variety of *Carex interior.* Rhodora **8**: 114, 115. 28 Je 1906.

Fernald, M. L. *Paronychia argyrocoma* and its New England representative. Rhodora **8**: 101–104. 28 Je 1906.

Fernald, M. L. Some new or little known *Cyperaceae* of eastern North America. Rhodora **8**: 126–130. 28 Jl 1906.

Includes descriptions of new species in *Cyperus* (2) and *Eleocharis*.

Fink, B. Further notes on cladonias. VII. *Cladonia subcariosa*, *Cladonia mitrula*, and *Cladonia leptophylla*. Bryologist **9**: 57–60. *pl. 4*. 2 Jl 1906.

Fink, B. The gynaecocentric theory and the sexes in plants. Plant World **9**: 179–185. [S] 1906.

Foslie, M. Den botaniske samling. K. Norske Vid. Selsk. Aarsb. **1905**: — (1–8). 1906.

Includes descriptions of new species in *Phymatolithon* and *Lithophyllum* (3), from the Pacific coast of North America.

Frye, T. C. *Nereocystis luetkeana*. Bot. Gaz. **42**: 143–146. *f. 1*. 30 Au 1906.

Ganong, W. F. The nascent forest of the Miscou beach plain. Bot. Gaz. **42**: 81–106. *f. 1–14*. 30 Au 1906.

Gilbert, B. D. Two anomalies and a curious sight. Bryologist **9**: 72. 2 Jl 1906.

Gleason, H. A. The pedunculate species of *Trillium*. Bull. Torrey Club **33**: 387–396. 1 Au 1906.

Two species are described as new.

Greene, E. L. Doctor Torrey and *Downingia*. Torreya **6**: 145–147. 25 Jl 1906.

Greene, E. L. Four streptanthoid genera. Leaflets **1**: 224–228. 8 S 1906.

Disaccanthus, *Cartiera*, *Guillenia*, and *Agianthus*, all proposed as new.

Greene, E. L. The genus *Batanthes*. Leaflets **1**: 224. 8 S 1906.

Greene, E. L. The genus *Leiostemon*. Leaflets **1**: 223. 8 S 1906.

Greene, E. L. The genus *Ptelea* in the western and southwestern United States and Mexico. Contr. U. S. Nat. Herb. **10**: i–v. 49–78. i. 16 Jl 1906.

Recognizes 59 species, of which 55 are described as new.

Greene, E. L. A new genus of *Rutaceae*. Leaflets **1**: 222, 223. 8 S 1906.

Taravalia, a segregate from *Ptelea*.

Greene, E. L. New western plants. Leaflets **1**: 221, 222. 8 S 1906.

Descriptions of new species in *Senecio* (3) and *Erigeron*.

Greene, E. L. Revision of the genus *Wislizenia*. Proc. Biol. Soc. Wash. **19**: 127–132. 6 S 1906.

Ten species are recognized, of which 7 are described as new.

Greene, E. L. Some Canadian antennarias.— III. Ottawa Nat. **20**: 71, 72. 5 Jl 1906.

Includes descriptions of 2 new species in *Antennaria*.

Greenman, J. M. Two new species from northwestern America. Bot. Gaz. **42**: 146, 147. 30 Au 1906.

Castilleja purpurascens sp. nov. and *Senecio Farriae* sp. nov.

Grout, A. J. Bryological notes. Bryologist **9**: 42–46. *pl. 3*. 3 My 1906.

Includes a description of *Burnettia fabrofolia* sp. nov.

Grout, A. J. "When doctors disagree." Bryologist **9**: 42. 3 My 1906.

Hackel, E. Ueber Kleistogamie bei den Gräsern. Oesterr. Bot. Zeits. **56**: 81–88. Mr 1906; 143–154. Ap 1906; 180–186. Je 1906.

Harper, R. M. Some more coastal plain plants in the Palaeozoic region of Alabama. Torreya **6**: 111–117. 20 Je 1906.

Harris, C. W. A list of foliaceous and fruticous lichens collected at Chilson Lake, Essex Co., New York. Bryologist **9**: 48–52. 3 My 1906.

Hasselbring, H. The appressoria of the anthracnoses. Bot. Gaz. **42**: 135–142. *f. 1–7*. 30 Au 1906.

Haynes, C. C. A list of hepatics collected in the vicinity of Little Moose Lake, Adirondack League Club tract, Herkimer Co., New York. Bryologist **9**: 62, 63. 2 Jl 1906.

Heller, A. A. Western species, new and old — V. Muhlenbergia **1**: 132–138. 24 Ap 1906; — VI. Muhlenbergia **1**: 144–147. 30 Jl 1906.

Includes descriptions of new species in *Ribes*, *Trifolium* (2), *Navarretia* and *Anaphalis*.

Hill, E. J. Distribution and habits of some common oaks. Bot. Gaz. **42**: 59. 28 Jl 1906.

Holm, T. *Eriophorum russeolum* Fr. versus *E. Chamissonis* C. A. Mey. Ottawa Nat. **20**: 62. 4 Je 1906.

House, H. D. A new southern *Convolvulus*. Torreya **6**: 149, 150 25 Jl 1906.

C. sericatus sp. nov., from Georgia.

House, H. D. A new species of *Dichondra*. Muhlenbergia **1**: 130, 131. 24 Ap 1906.
D. occidentalis, from Southern California and Lower California.

House, H. D. Nomenclatorial changes in the *Orchidaceae*. Muhlenbergia **1**: 127–129. 24 Ap 1906.

House, H. D. A note upon *Ipomoea cuneifolia* A. Gray. Torreya **6**: 123, 124. 20 Je 1906.

House, H. D. Notes on southern violets — I. Torreya **6**: 171–173. 25 Au 1906.
Including a description of *Viola reduncа* sp. nov.

House, H. D. The violets and violet hybrids of the District of Columbia and vicinity. Rhodora **8**: 117–122. *pl. 71, 72.* 28 Jl 1906.

Howe, R. H. *Ramalina rigida* in Massachusetts. Bryologist **9**: 54. 3 My 1906.

Howe, R. H. Some lichens of Mt. Watatic, Massachusetts. Bryologist **9**: 46–48. 3 My 1906.

Jeffrey, E. C. & Chrysler, M. A. On Cretaceous *Pityoxyla*. Bot. Gaz. **42**: 1–15. *pl. 1, 2.* 28 Jl 1906.

Jennings, O. E. Additions and corrections to the list of the vascular flora of Allegheny County, Pa. Ann. Carnegie Mus. **3**: 473–479. Jl 1906.

Jennings, O. E. A new species of *Ibidium* (*Gyrostachys*). Ann. Carnegie Mus. **3**: 482–486. *pl. 20.* Jl 1906.
I. incurvum, from Pennsylvania.

Jennings, O. E. A new species of *Kneiffia*. Ann. Carnegie Mus. **3**: 480, 481. *pl. 19.* Jl 1906.
K. Sumstinei, from Pennsylvania.

Jennings, O. E. A note on the occurrence of *Triglochin palustris* Linnaeus in Pennsylvania. Ann. Carnegie Mus. **3**: 482. Jl 1906.

Kellerman, W. A., Gleason, H. A. & Schaffner, J. H. Spring flora for beginners and amateurs. i–xiii. 1–188. Columbus, Ohio, 1906.

Kirkwood, J. E. The pollen-tube in some of the *Cucurbitaceae*. Bull. Torrey Club **33**: 327–346. *pl. 16, 17.* 20 Jl 1906.

Knight, O. W. *Viola Novae-Angliae* in the Penobscot valley. Rhodora **8**: 115. 28 Je 1906.

Krasser, F. & Rechinger, K. Bearbeitung der von Professor von Höhnel im Jahre 1899 in Brasilien gesammelten Melastomaceen. Oesterr. Bot. Zeits. **56**: 191–195. Je 1906.
Includes 2 new species in *Leandra*.

Lawrence, W. H. Apple scab in eastern Washington. Wash. Agr. Exp. Sta. Bull. 75: 1–14. 1906.

Lloyd, F. E. Palo verde: the evergreen tree of the desert. Plant World **9**: 165–171. *f. 22–25.* [Au] 1906.

Mackenzie, K. K. Notes on *Carex* — I. Bull. Torrey Club **33**: 439–443. 30 Au 1906.
Descriptions of 4 new species.

Mackenzie, K. K. *Ranunculus sicaeformis* Mackenzie & Bush, sp. nov. Torreya **6**: 123. 20 Je 1906.

Maxon, W. R. Report on a collecting trip in Costa Rica. Jour. N. Y. Bot. Gard. **7**: 187–193. *f. 23, 24.* Au 1906.

Merkel, H. W. A deadly fungus on the American chestnut. Ann. Rep. N. Y. Zool. Soc. **10**: 97–103. Ja 1906. [Illust.]

Merrill, G. K. Lichen notes no. 3. "Chemical tests" in determining lichens. Bryologist **9**: 66–71. Je 1906.

Moore, C. L. The *Myxomycetes* of Pictou County [Nova Scotia]. Bull. Pictou Acad. Sci. Assoc. **1**: 11–16. Je 1906.

Nash, G. V. The flowering of Queen Victoria's *Agave.* Jour. N. Y. Bot. Gard. **7**: 163–167. *f. 21, 22.* Jl 1906.

Nelson, A. Contributions from the Rocky Mountain Herbarium VII. Bot. Gaz. **42**: 48–54. 28 Jl 1906.
Includes descriptions of 14 new species in 11 genera.

Osterhout, G. E. Colorado notes: descriptions of new species. Muhlenbergia **1**: 139–143. 30 Jl 1906.
Eight new species in as many genera.

Osterhout, W. J. V. On the importance of physiologically balanced solutions for plants. I. Marine plants. Bot. Gaz. **42**: 127–134. 30 Au 1906.

Peirce, G. J. *Anthoceros* and its *Nostoc* colonies. Bot. Gaz. **42**: 55–59. 28 Jl 1906.

Piper, C. V. North American species of *Festuca.* Contr. U. S. Nat. Herb. **10**: i–ix. 1–49. *pl. 1–15.* 30 Mr 1906.
Includes descriptions of 5 new species.

Porsch, O. Beiträge zur "histologischen Blütenbiologie." II. Weitere Untersuchungen über Futterhaare. Oesterr. Bot. Zeits. **56**: 41–47. F 1906; 88–95. Mr 1906; 135–143. *pl. 3.* Ap 1906; 176–180. Je 1906.

Ramaley, F. Plants of the Florissant region in Colorado. Univ. Colo. Stud. **3**: 177–185. Je 1906. [Illust.]

Ramaley, F. The seed and seedling of the mountain globe-flower. Univ. Colo. Stud. **3**: 93–95. *f. 1–13.* Mr 1906.

Reed, H. S. & Smoot, I. The mechanism of seed-dispersal in *Polygonum virginianum.* Bull. Torrey Club **33**: 377–386. *f. 1–7.* 1 Au 1906.

Robinson, B. L. Studies in the *Eupatorieae.* Proc. Am. Acad. Arts & Sci. **42**: 1–48. 24 My 1906.

With new species in *Piqueria* (4), *Helogyne, Alomia, Stevia, Trichogonia,* and *Eupatorium* (8).

Rose, J. N. *Terebinthus Macdougali,* a new shrub from Lower California. Torreya **6**: 169–171. *f. 5.* 25 Au 1906.

Rusby, H. H. A historical sketch of the development of botany in New York City. Torreya **6**: 101–111. 20 Je 1906; 133–145. 25 Jl 1906.

Rydberg, P. A. *Bossekia* or *Rubacer.* Torreya **6**: 165–169. 25 Au 1906.

Rydberg, P. A. Flora of Colorado. Agr. Exp. Sta. Colo. Bull. 100: i–xxii. 1–448. *map.* [Au] 1906.

Schiffner, V. Bemerkungen über *Riccardia major* S. O. Lindb. Oesterr. Bot. Zeits. **56**: 169–174. Je 1906.

Shantz, H. L. A study of the vegetation of the Mesa region east of Pike's Peak. I. Structure of the formation. Bot. Gaz. **42**: 16–47. *f. 1–7.* 28 Jl 1906.

Shreve, F. The development and anatomy of *Sarracenia purpurea.* Bot. Gaz. **42**: 107–126. *pl. 3–5.* 30 Au 1906.

Shreve, F. A winter at the tropical station of the Garden. Jour. N. Y. Bot. Gard. **7**: 193–196. Au 1906.

Smith, A. M. A list of mosses collected on the Adirondack League Club tract, Herkimer Co., New York. Bryologist **9**: 63–66. 2 Jl 1906.

Spalding, V. M. Absorption of atmospheric moisture by desert shrubs. Bull. Torrey Club **33**: 367–375. 1 Au 1906.

Sprague, T. A. *Gurania malacophylla.* Curt. Bot. Mag. IV. **2**: *pl. 8085.* 1 Jl 1906.

Native of Brazil.

Squires, W. A. The passing of the prairie flora. Plant World **9**: 162–164. [Au] 1906.

Towle, P. M. Notes on the life-history of the mniums. Bryologist **9**: 54–56. 3 My 1906.

Walker, E. R. On the structure of the pistils of some grasses. Univ. Stud. [Univ. of Nebraska] **6**: 203–218. *pl. 1–5*. Jl 1906.

Watts, W. W. Australian mosses: some locality pictures. Bryologist **9**: 34–36. 3 Mr 1906; 41. 3 My 1906.

Winton, A. L. The microscopy of vegetable foods. i–xvi. 1–701. *f. 1–589*. New York, 1906.

Wright, C. H. *Rhodostachys pitcairniifolia*. Curt. Bot. Mag. IV. **2**: *pl. 8087*. 1 Au 1906.
Native of Chile.